APPLIED HYDRAULICS

THE MAGAZINE OF FLUID POWER TRANSMISSION

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JULY, 1950

- HYDRAULIC CIRCUITS
- HYDRAULIC CONTROLS
- IR CIRCUITS
- R CONTROLS
- LECTRICAL AND LECTRONIC ONTROLS

IN THIS ISSUE

REACHING ONE AND TWO MILES DOWN. PAGE 15
IT'S AN OLD SMOOTHIE! PAGE 19

"BREAKAWAY"

For efficient operation of hydraulically-controlled implements, the Aeroquip "Breakaway" Coupling is the ABC rule. This rugged, field-proven unit provides two important services: it eliminates the breaking of hose lines and loss of hydraulic fluid whenever the implement breaks away from the tractor; it permits quick, easy connection and disconnection of implements and tractor. (Photo courtesy of International Harvester Company.)

Aeroquip

The "Breakaway", consisting of twin Self-Sealing Couplings mounted on a frame, connects both hydraulic pressure and return lines between tractor and pull-behind implements. The "Breakaway" can be separated by a tug on either hose line or by tripping the trigger manually. When uncoupled, both halves seal automatically keeping hydraulic fluid in and preventing dirt and air from entering the hydraulic system. The "Breakaway" can be reconnected easily even when under pressure. Operation is simple and foolproof.

Always first

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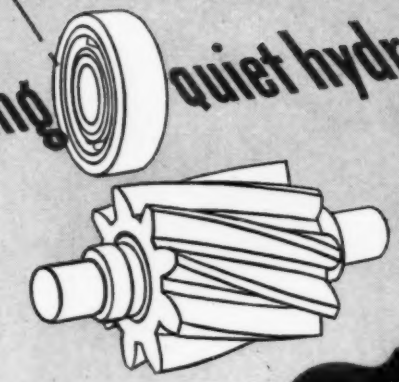
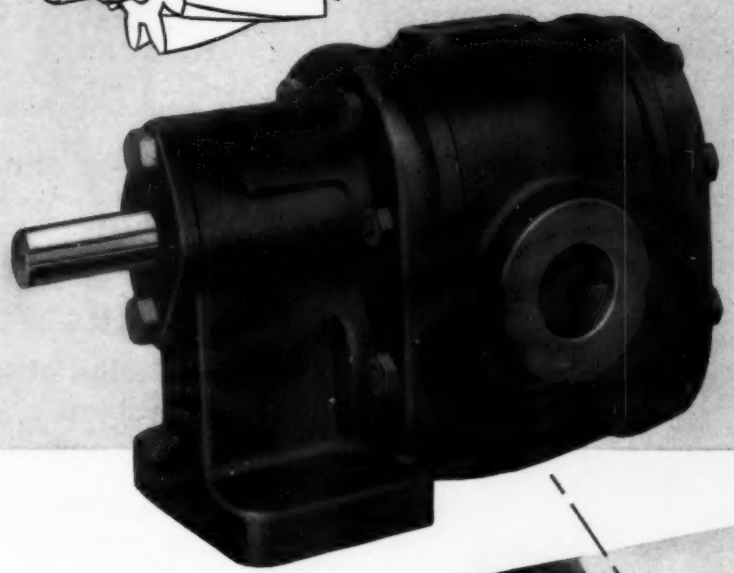
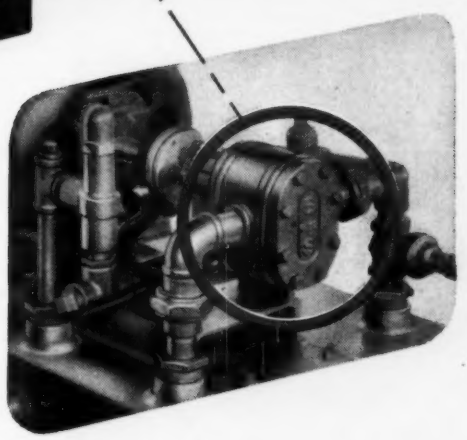
AEROQUIP PRODUCTS ARE FULLY PROTECTED BY PATENTS IN U. S. A. AND ABROAD

Smooth-operating quiet hydraulic systems start here







Rotary Geared Pumps with Helical Gears and Roller Bearings

Here's an easy way to add extra features to the design of hydraulically-operated machines . . . a quiet-operating pump that provides smooth continuous flow. By specifying Brown & Sharpe Rotary Geared Pumps with helical gears made to extreme accuracy and operating on roller bearings, you can assure these features. What's more, trouble-free service life of the pump is extended too!

Brown & Sharpe Rotary Geared Pumps with helical gears and roller bearings are made in two sizes: No. 53 — 4 to 23.3 gallons per minute at 0 lbs. pressure; and No. 55 — 9 to 34.1 gallons per minute at 0 lbs. pressure. Although designed for direct drive, these pumps may be driven by pulley or gear. Made to run in one direction only, either clockwise or counterclockwise. Leakage and gland adjustments present no problems because the pumps have a mechanical seal.

Let these pumps help you *advance* your machine design by supplying oil under pressure for hydraulically-operated machines, or for lubrication systems where quietness is essential. Get all the facts. Write for Pump Catalog. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

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JULY, 1950
Vol. 3 No. 6

APPLIED HYDRAULICS

The Magazine of Fluid Power Transmission

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LOS ANGELES OFFICE
FRED W. FRISENFELDT
Industrial Publishing Co.
Room 403
1250 Wilshire Blvd.
Los Angeles 17, Calif.
TUcker 4703

Applied Hydraulics is indexed regularly by Engineering Index, Inc.

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FRONT COVER: **Breakaway couplings between the hydraulically controlled implement and tractor are being fastened. If the implement pulls away from the tractor, both halves of the coupling seal, preventing loss of fluid and broken lines.**

Courtesy International Harvester Company

CONTENTS

Reaching One and Two Miles Down 15

Power and Control for Slitter Line 18

It's an Old Smoothie! 19
By C. P. Jessup

AVIATION HYDRAULICS SECTION

Selection and Design of Components for Pneumatic Systems 22
By J. Alan Campbell

Constant Flow Regulators in Aircraft Hydraulic Systems 24
By John R. McGuire

BASIC HYDRAULICS SECTION

Directional Valves
Chapter VII, Part I 28

Advertisers Index 48

DEPARTMENTS

LETTERS TO THE EDITOR 7

LITERATURE IN THIS MONTH'S ADS 10

USEFUL LITERATURE 32

MARKET PLACE 34

NEW PRODUCTS 35

POST SCRIPTS OF INDUSTRY 38

DIGESTS 40

Published monthly by THE HYDRAULICS PUBLISHING CO., an affiliate of INDUSTRIAL PUBLISHING CO., publishers of COMMERCIAL REFRIGERATION AND AIR CONDITIONING, DIE CASTINGS, FLOW, INDUSTRY & WELDING, OCCUPATIONAL HAZARDS, and THE TAXICAB INDUSTRY. Member, Controlled Circulation Audit, Inc., and National Business Papers Association.

Subscription rates: United States and possessions—$3.00 per year, $5.00 for 2 years; Canada—$4.00 per year, $6.00 for 2 years; Foreign—$5.00 per year. Single copy price, 30 cents. All subscriptions subject to individual acceptance by the publisher.

LETTERS to the Editor

We are a large scale distributor of earth moving equipment and other hydraulically controlled implements and machinery. We are particularly interested in the unit type of assembly with the pump, reservoir and control valves all assembled into a single unit, ready for mounting onto the power take-off of a given tractor. We shall be grateful if you can forward us the names of a few reliable manufacturers.

MACHINA, LTD.,
Capetown, South Africa

The names of several American manufacturers of this type of equipment and who are interested in doing foreign business have been forwarded to you.

In the January, 1950, issue of APPLIED HYDRAULICS (page 8) a Mr. W. G. asked among other questions "Could you recommend a high flash hydraulic oil for coal loading machines?" We have developed a series of non-flammable type hydraulic fluids for various aviation and industrial uses, one of which was developed primarily as a non-flammable type, non-toxic hydraulic fluid exclusively for use in underground equipment. This fluid has been satisfactorily service tested in a coal cutting machine in actual operation underground. We would appreciate it if you could furnish us W. G.'s full name and address.

H.S.L.

This information has been forwarded.

We are planning a course covering pneumatic equipment and its various applications and would appreciate advice on books and manuals available.

A.B. JR.

We're sending you a copy of our APPLIED HYDRAULICS *Data List, which is a listing of some of the leading technical books, bulletins, manuals and catalogs on both the hydraulic and pneumatic fields. Several other sources of material have also been suggested.*
P.S. We still have a limited supply of the present Data Lists which will be sent to readers on request. A larger and more comprehensive Data List is being prepared for fall distribution.

I would like to receive a reprint of the article "The Selection and Application of High Pressure Pumps and Fluid Motors".

J.M.

This article appeared in the January, 1950, issue of APPLIED HYDRAULICS *which is now entirely exhausted. However, a reprint of the article is available from the author.*

High-Production Honing Machine Uses GREER ACCUMULATOR to Speed up Operation, Cut Down Size of its Pump and Motor

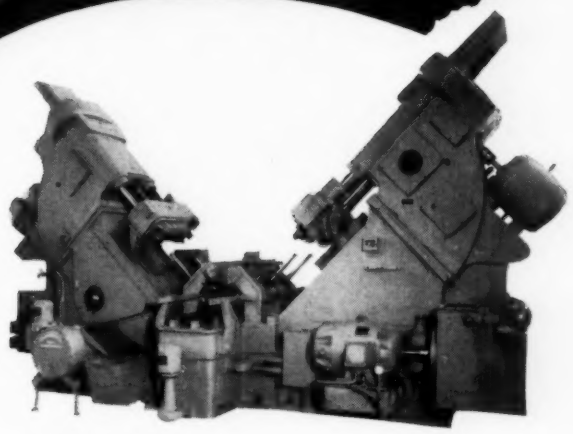

Photo Courtesy of:
Barnes Drill Co., Rockford, Ill.

THE Barnesdril Duplex Angle Type Honer #320 illustrated above, especially designed to meet the high-production requirements of one of America's leading automobile manufacturers, is a vivid example of the wonders of modern machinery.

Its operation is similar to other honing machines in which the honing process is accomplished by the simultaneous rotation and reciprocation of a tool incorporating a number of honing sticks and stones of the proper grit and grade.

However, unlike older type honers which use a ratchet or screw to control the expansion and contraction of the tool, Model 320 uses a Greer Accumulator and a hydraulic cylinder indirectly operating a pushrod to accomplish this operation at the greatly accelerated speed so important for high-production honing.

This rapid expansion and contraction of the tool is made possible by the Greer Accumulator which stores fluid during the comparatively slow work cycle and then releases it instantaneously in large volumes during the expansion and contraction cycle. The accumulator also makes it possible to use a much smaller pump to obtain the necessary large volume of oil.

By redesigning your own process or machine to incorporate a Greer Accumulator, you too can cut unit cost, save floor space and increase production.

Our Bulletin 300 "Hydro-Pneumatic Accumulators" describes in detail the construction features and industrial applications of Greer Accumulators. Write for your copy on your company letterhead.

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CAPACITY
From 2 cubic inches to 10 gals.
PRESSURE
Up to 3000 psi
TYPICAL USES
As a storage chamber and Shock absorber.
As an emergency source of fluid power.
For operating secondary systems.
As a dispenser of oils or greases.
As a thermal expansion compensator.
To reduce size of power unit in intermittent duty cycles.

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EASY DOES IT with

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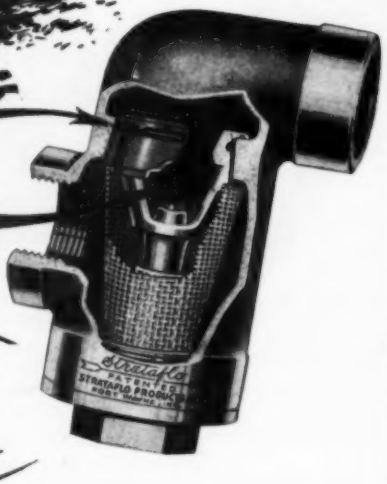

CHECK VALVE AND STRAINER by Strataflo

- "Engineered for service," this Strataflo* No. 550 Combination Check Valve and Strainer operates quietly, seals securely, and is readily accessible for cleaning.
- These time-tested units developed by Strataflo Products Inc. of Fort Wayne, Ind. for use in the suction line of low-lift turbine pumps and similar services include the simplified and certain sealing provided by GRC precision "O" rings and GRC custom-molded leak-proof poppets.

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AND FOR Your PRODUCT—

- GRC "O" ring seals offer a simple but certain method to effect important design economies through reduced machining, fewer parts and ease of assembly.
- Secure, life-long sealing is assured by GRC top-quality "O" ring seals, held to rigid standards that control consistent material content and close-tolerance dimensional exactness.
- The extensive engineering experience of GRC's technical and sales engineers is available to assist in the adaption of this modern seal to your product. A request copies of Catalog "C" and Bulletin P-112.

For valuable data on AN6227, AN6230 and AN6290 series "O" rings, write for your free copies of Catalog "C" and Bulletin P-112.

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MOLDED RUBBER SPECIALTIES, WASHERS

QUALITY MECHANICAL RUBBER GOODS FOR 34 YEARS

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Could you give us the names of companies that furnish non-flammable hydraulic fluids? Will you send copies of APPLIED HYDRAULICS in which you have run such material?

C.M.S.

The names of several companies that offer non-flammable or flame resisting hydraulic fluids has been sent you. We are also sending you copies of September 1948 and May 1949 issues in which articles on this subject appeared.

I wonder if you can give me a reference, either to a standard text book or to previously published data in APPLIED HYDRAULICS in which the following topics are fully covered: (1) Formula for computing pressure drop through ring plate type compressor valves for air or various gases; (2) formula for calculating the optimum spring pressure to pressure drop relation in ring plate valves on air and gas service; (3) formula for calculating valve closing time ratios vs time, piston travel, etc.; (4) pump valves for handling liquified gases at pressures in the nature of 3000 to 5000 psig at temperatures of minus 80 to 100 F. Any information you can provide as to sources for this data will be appreciated.

W.C.A.

The specific data requested is not found in any of the standard manuals in our own library nor in the working files of several district offices of compressor manufacturers. We are still trying to run down adequate answers for you. We invite our readers who may have such information to write the Editor.

Please! May I be placed on your mailing list to receive APPLIED HYDRAULICS?

B.S.B.

Your company and your position with it qualifies you for copies. We are pleased to add your name.

I have recently received copies of the April and May issues of your magazine APPLIED HYDRAULICS. I am very much interested in the articles under the heading "Beginners' Course in Basic Hydraulics". I would very much appreciate receiving the preceding installments on this subject.

C.R.V.

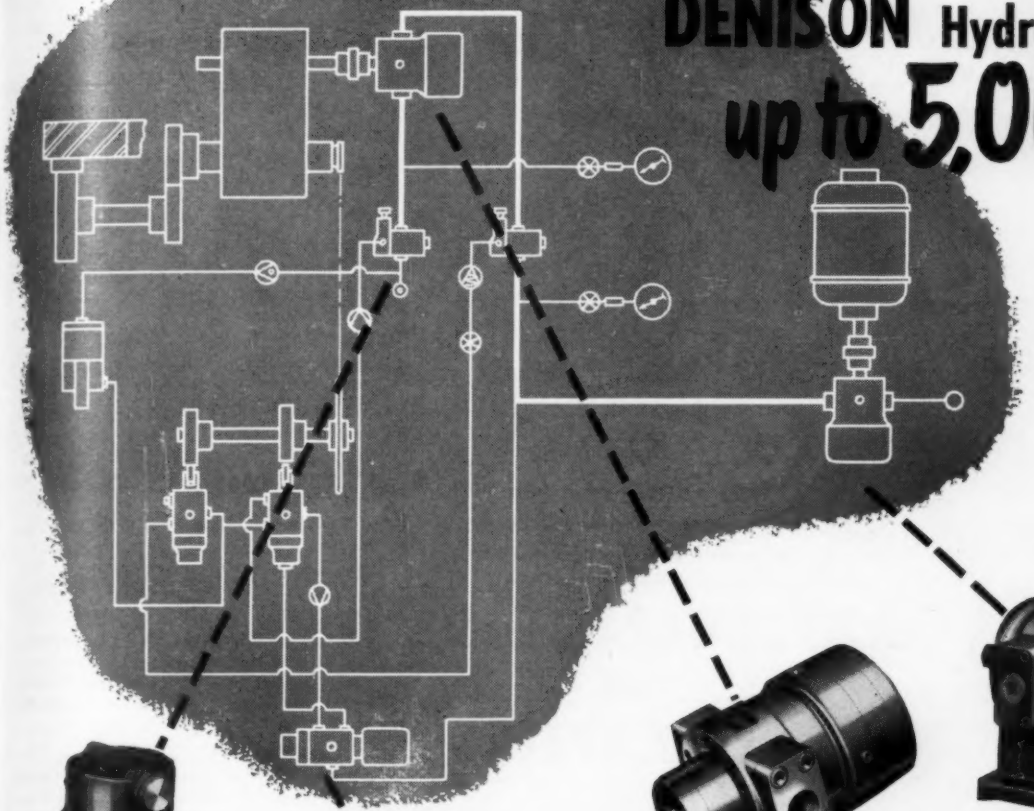
This series has been running since March, 1949, and, due to the interest, we are not able to furnish most of the back copies. Ordinarily we can furnish back copies for several months previous to the current issue. The series as modified for our readers will run approximately two years longer.

The writer happened to notice a letter by "T.C.F." in the May, 1950, issue, page 6, requesting comparison data on flexible couplings. It may interest you that an article by the writer, "Selecting Flexible Couplings" appeared in "Machine Design" for April, 1949, pp 117-125. This was compiled from data furnished by 45 manufacturers of flexible couplings and is believed fairly comprehensive.

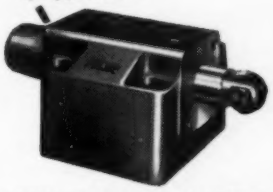
A.F.G. JR.

Faster Operation with Higher Pressures

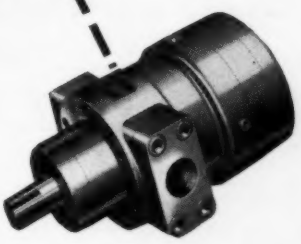
DENISON Hydraulic Circuits up to 5,000 psi



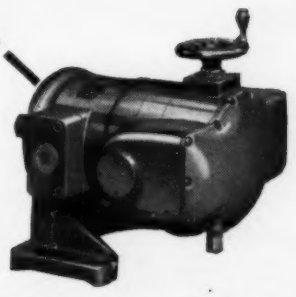
PRESSURE CONTROL VALVES. Denison Relief, Sequence and Unloader Valves attain smoother operation and higher efficiency by reducing the differential between opening and closing pressures. This uniformity of pressure application brings more uniform operation of the equipment involved. All three types of valves are available in the same compact body types, in ¾", 1¼", and 1½" sizes. Remote control valves also available for use with these valves.



4-WAY DIRECTIONAL CONTROLS. Denison 4-way valves are available in all types, with a wide variety of controls for operating pressure including hand lever, electric solenoid, cam, stem, and several types of pilot control. Their quality is reflected in such features as full diameter spool extensions for the entire spool length, and gasket-free, metal-to-metal assembly. Threaded or subplate type bodies, in all sizes from ¼" to 1½".



FLUID MOTORS. Denison fluid drives—in 3 to 160 hp capacities are noted for exceptional compactness, ruggedness, and stamina. They're shockproof, too — can be started, stopped, reversed, or used for braking at full speed and pressure. Other features include stepless speed variation, self-lubrication, high starting torque from any position. Capacities to 3000 rpm.



PUMPS. Denison axial-piston pumps are available for either constant volume operation, or with variable control of pump volume, for all circuit needs up to 5000 psi. Capacities up to 35 gpm at 1200 rpm. Smaller sizes may be operated at 1800 rpm for increased volume when required. These pumps feature complete hydraulic balance throughout, which assures highest efficiency and minimum noise, making them ideal for circuits demanding both power and speed.

In the advanced engineering of Denison's extensive line of pumps, fluid motors, valves, and pumping units, you'll find the key to higher efficiency for every hydraulic circuit need within the 5000 psi range. In addition, these Denison HydrOILic units are remarkably compact. They save space, and are easier to connect in close quarters or into complex setups. And their compactness gives them extra ruggedness, enables them to stand up longer under harder punishment. Whatever your hydraulic circuit needs may be, turn them over to Denison! Write today—no obligation.

NEW SURGE DAMPER

Hydraulic shock is destructive

Denison's new surge damping valve prevents shock in most hydraulic circuits. It assures quiet, smooth hydraulic power and adds life to your entire hydraulic system. No adjustment required. No slowdown in cycle time. Easily installed. Let us send full details.

DENISON HydrOILics

The DENISON Engineering Co.
1166 Dublin Road, Columbus 16, Ohio

PUMPING Aviation GASOLINE

WITH THE

ROPER TANK TRUCK PUMP

3600 SERIES

ROPER PUMP refueling a TWA Constellation with 100-octane aviation gasoline

AMPLE CAPACITIES *at* SLOW SPEEDS

The Roper 3600 Pump in this Texaco tank truck unit helps to maintain speedy, efficient refueling at busy LaGuardia Field. In this instance, fast refueling is gained by the Roper providing *ample capacity* at *slow speeds*... high RPM, which puts terrific strain on engine and pump alike, is not necessary. This Roper Pump series features equal size, hardened pumping gears running in axial hydraulic balance, an extra deep packing box with split-type gland for easy repacking, an ample size relief valve to permit shut-off without stopping pump, many other construction details which add to long service life and low maintenance costs.

REFUELING AND DEFUELING

In instances where aircraft repairs necessitate emptying of fuel tanks, rugged Ropers are equally efficient. Self-priming at all times, they defuel immediately after the engine is started in reverse. Perhaps you have a similar application where Roper adaptability will pay off. Investigate this dependable line today!

Send for Descriptive Catalog and Facts.

GEO. D. ROPER CORP.
707 Blackhawk Park Ave.
ROCKFORD, ILLINOIS

ROPER *Rotary Pumps*

DEPENDABILITY SINCE 1857

LITERATURE AND SERVICES OFFERED IN THIS MONTH'S ADS

NOTE: Circle numbers on the enclosed business reply card to indicate literature or services you wish to receive.

A-1. ADEL PRECISION PRODUCTS CORP. A new descriptive bulletin containing detailed information on Adel's line of industrial equipment is available.

A-2. THE COMMERCIAL SHEARING AND STAMPING CO. A 52 page catalog describing Commercial's hydraulic cylinders is now ready for distribution.

A-3. BROWN & SHARPE MFG. CO. A pump catalog describing their rotary geared pumps is offered.

A-4. CHIKSAN COMPANY. A bulletin describing the complete line of hydraulic swivel joints which have a capacity from 1000 to 3000 psi is available.

A-5. CUSHMAN CHUCK COMPANY. Catalogs have been prepared showing Cushman's wrench operated chucks and power operated chucks.

A-6. DARLING VALVE & MFG. CO. Darcova Pumpcaps for reciprocating pumps are described in Bulletin 4401. Packing for air and hydraulic cylinders is illustrated in Bulletin 4502.

A-7. DENISON ENGINEERING CO. Denison offers engineering service for hydraulic circuit requirements. Details on the new surge damper are now available.

A-8. FULFLO SPECIALTIES CO., INC. Included in the new Fulflo Mechanical Data Book are complete descriptions of their oil-relief and by-pass valves.

A-9. HANNIFIN CORPORATION. Four bulletins are offered. Each describes a type of hand or foot operated air control valve.

A-10. HUFFORD MACHINE WORKS INC. Engineering recommendations and estimates for building hydraulic equipment can be had.

A-11. C. B. HUNT & SON, INC. Data sheet 1741 supplies information on the Quick-As-Wink high cycle solenoid valves.

A-12. MARVEL ENGINEERING CO. Filtration units for non-corrosive liquids in circulating and low pressure systems are presented in catalogs 104 and 202.

A-13. ORTMAN-MILLER MACHINE CO., INC. Material describing the 3 in bore hydraulic cylinder is available.

A-14. GEO. D. ROPER CORPORATION. A catalog providing data on the Roper 3600 series tank truck pump is ready for distribution.

A-15. ROSS HEATER & MFG. CO., INC. Bulletin 2.2K1 describing and illustrating the design features of the Ross Type BCP heat exchanger is being sent by this company.

(Continued on page 26)

Reaching One and Two Miles Down

A portable rotary drilling and serving rig equipped with a hydraulic circuit to raise and lower a 90 foot mast; and air clutch control of main and sand line drums, rotary table and countershaft drive shafts.

THE CARDWELL MANUFACTURING Co., Inc., Wichita, Kansas, manufacturers of oil field drilling and servicing equipment, offers a portable, rotary drilling and servicing rig, complete with mast, semi-trailer mounted, with a hydraulic system to raise and lower the mast and a total of seven plate type clutches for main drum, sand line drum, rotary table and counter-drive shaft control. The unit, Model TR Trailerig—is designed for general drilling requirements to 5000 feet and for servicing work to 10,000 feet.

The Trailerig is a complete, self-contained, twin-engine drilling and workover rig. Figure 1 shows the unit in traveling position. The four leg telescoping tubular mast extends to 90 feet above the driller's platform. A bolted type racking platform (16 ft 7 in x 15 ft 1 in) has capacity for racking 6000 feet of 4½ in drill pipe in doubles, 10,000 feet of 2⅞ in drill pipe in doubles or 10,000 feet of 3 in tubing in doubles. In spite of the massive size—e.g., the mast has a design crown block load of 200,000 pounds—the rig is fully portable without dismantling block, mast or engines.

The main frame consists of structural steel members electrically welded into a one-piece rigid frame, which forms the supports for the various shaft assemblies and at the same time forms a semi-trailer type frame for the entire rig. The frame is supported on rocker beam type axles, providing for lateral and transverse oscillation of the trailer frame. Double bodies are equipped with 16 wheels, the 7.50 x 20 tires assuring ample carrying capacity.

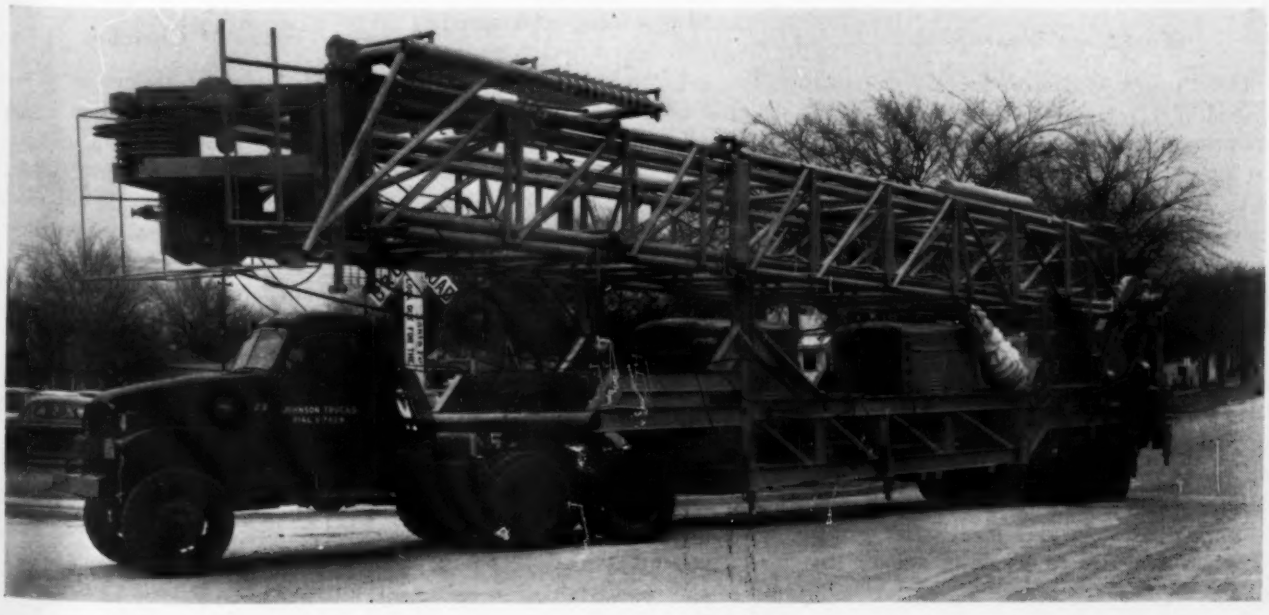
The mast is directly mounted on the trailer frame, one end of the frame forming the base of the mast when elevated. Figure 2 shows the rig in working position. When in the travelling position, the telescoped mast is supported by structural brackets at the front end of the trailer frame. The rig is jack supported and leveled during operation.

The hydraulic circuit for raising and lowering the mast is show schematically in Figure 4.

To Raise Mast

The plunger of special control valve 1 is pulled out, allowing high pressure oil to flow in port A and out port C, through flow control valve 3 to the telescoping cylinder 6. The

Fig. 1. The Trailerig in travelling position. The rig, fully portable without dismantling block, mast or engines, has an overall travelling length of 59 ft 3 in.



plunger of diverting valve 2 is depresed at the beginning of the operation by the pad on the retracted telescopic cylinder, allowing high pressure oil from port C to flow in port F of the diverting valve 2 and out port G, through the flow control valve 4 to the single-acting cylinder 7. Both flow control valves, 3 and 4, restrict flow away from the cylinder only.

Single-acting cylinder 7 extends first since it does not work against a load; then telescopic cylinder 6 begins to extend. As it does so, the plunger of diverting valve, which is spring loaded, moves out from its depressed position, closing off high pressure port F and opening the single-acting cylinder line to port D of control valve 1 by connecting port G to port H. A check valve with a 50 pound spring, located in the plunger of control valve 1, prevents the oil in the line from port D to the single-acting cylinder 7 from flowing back to the tank while the mast is being raised. This check assures full extension of the single-acting cylinder as it comes into contact with the mast pad just before the mast goes over center.

As the mast goes over center, its weight causes depression of the single-acting cylinder 7, forcing the oil through the flow control valve 4, which regulates the return flow so that the mast is lowered over the center but always under control. When the single-acting cylinder 7 is completely depressed and the mast is in its vertical drilling position, the plunger of control valve 1 is returned to neutral.

To Lower Mast

The plunger of control valve 1 is pushed in, allowing high pressure oil from the pump to flow in port A and out port D, through the diverting valve 2 ports H and G to the single-acting cylinder 7. Extension of the cylinder causes the mast to be tipped back over center into the lowering position. When cylinder 7 is fully extended, pressure is built up in the line; this pressure opens unloading valve 5, so that flow from the pump recirculates at low pressure back to the resrevoir during the remainder of the mast lowering operation. Unloading valve 5 resets itself after control valve 1 is returned to neutral.

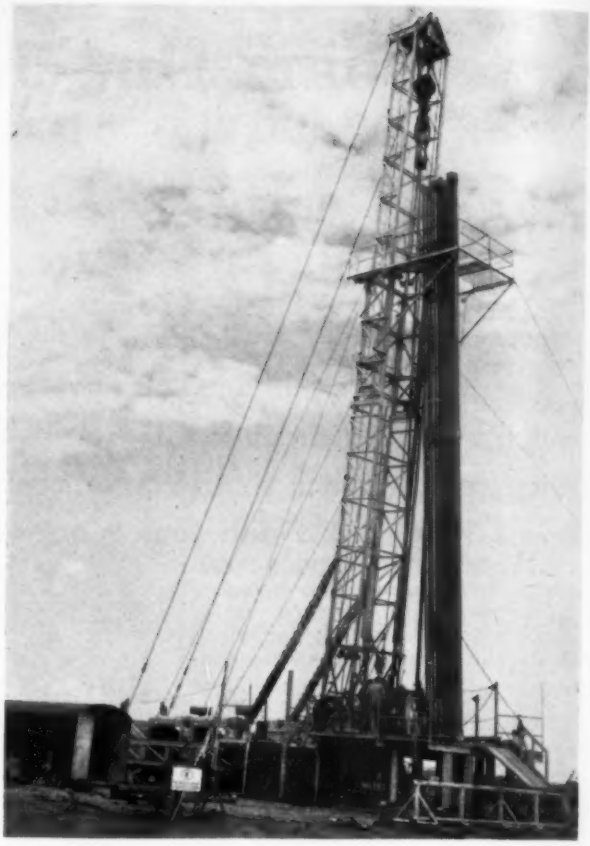


Fig. 2. The Trailerig at work, drilling with 3½ in drill pipe at 3700 feet near New Castle, Wyoming. The installation is equipped with mud pump drive.

As the mast is pushed over center by cylinder 7, the telescopic cylinders begin to retract, the rate of speed at which the mast lowers being regulated by flow control valve 3. At the completion of the lowering operation, control valve 1 is again returned to neutral, ending the cycle.

Air clutches are extensively used on the rig. Air clutches are used on either end of the main drum, Figure 3, one clutch providing high speed to the drum, the opposite clutch providing the low drive. When a sand line drum is used, it is mounted to the rear of the main drum and is operated by an air clutch mounted in one of the drum ends.

Air Clutches

Air clutches are also provided on the rotary drive to the table end and on the countershaft drive shaft to stop cathead and chain operation during rotation of the rotary table. The clutch is mounted on the rear rotary shaft, inside the trailer framework for better protection. An air operated rotary brake is mounted on the front shaft for quickly stopping rotation of the rotary table.

In addition the main pump drive sheave is equipped with an air operated clutch.

All air clutches are plate type construction with long-life molded plates. Actuation is by direct air pressure on an air diaphragm. The diaphragms are molded of a synthetic compound with a fabric core for long life; they are not affected by oil or water and are thoroughly insulated from any action by heat.

Types of Clutches

All of the seven air clutches, except that at the transmission input point, are Cardwell's own design. Existing types, with one exception, had the actuating elements applied by a member which had a sealing ring around the outer periphery. This sealing ring provided some air seepage possibilities. The company's own design utilized the clamped diaphragm on the inner and outer peripheries, in this way providing an air chamber with a means of preventing any air leakage.

At the transmission input point, a clutch was needed that could be connected and disconnected and would also provide the characteristic

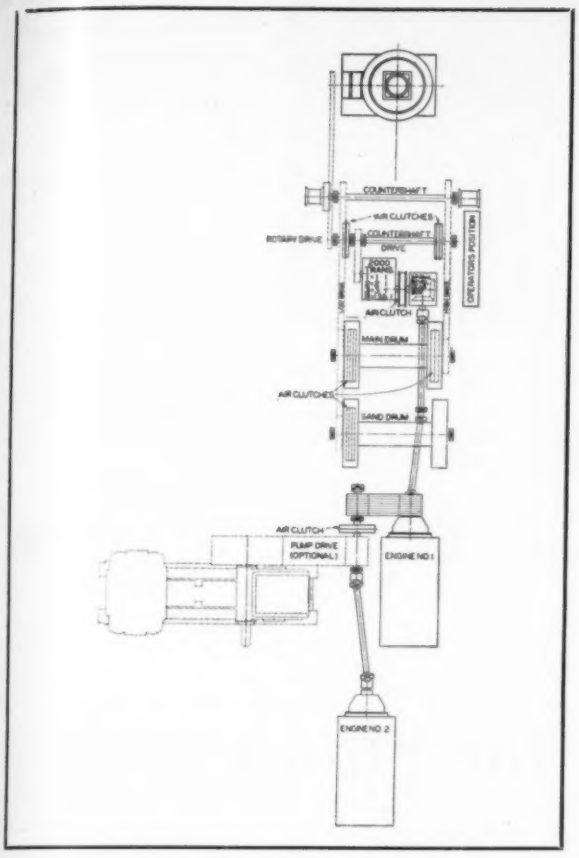


Fig. 3. Arrangement of air clutches on main and sand drums, pump drive, rotary drive and on transmission input and output, the latter to stop cathead and chain operation during operation of the rotary table.

of a flexible coupling. Further, it was required that this construction take up a minimum of space along the shaft (Figure 3). Since one standard air clutch answered all of these requirements, it was used at this point.

Air type controls with throttling valves are used where a graduated degree of action is desired. Instruments are grouped on a panel convenient to the operator's position. An emergency stop control is provided on the panel.

Gear Transmissions; Torque Converters

Either a heavy-duty gear type transmission or hydraulic torque converter may be used. When a gear transmission is employed, an air actuated friction clutch is provided between the transmission and the gear box so that the power may be disconnected when shifting gears. When the torque converter is used, it is mounted directly on the flywheel housing of the engine.

The rig is designed to be powered by either diesel or gasoline engines with approximate horsepower rating of 348 hp.

The use of hydraulic and air circuits in the Trailerig has not only made possible an unusually large portable unit; such circuits have simplified operation, made safety interlocks and panelized controls fool-proof and convenient, reduced weight, shortened setup time and increased actual production work time.

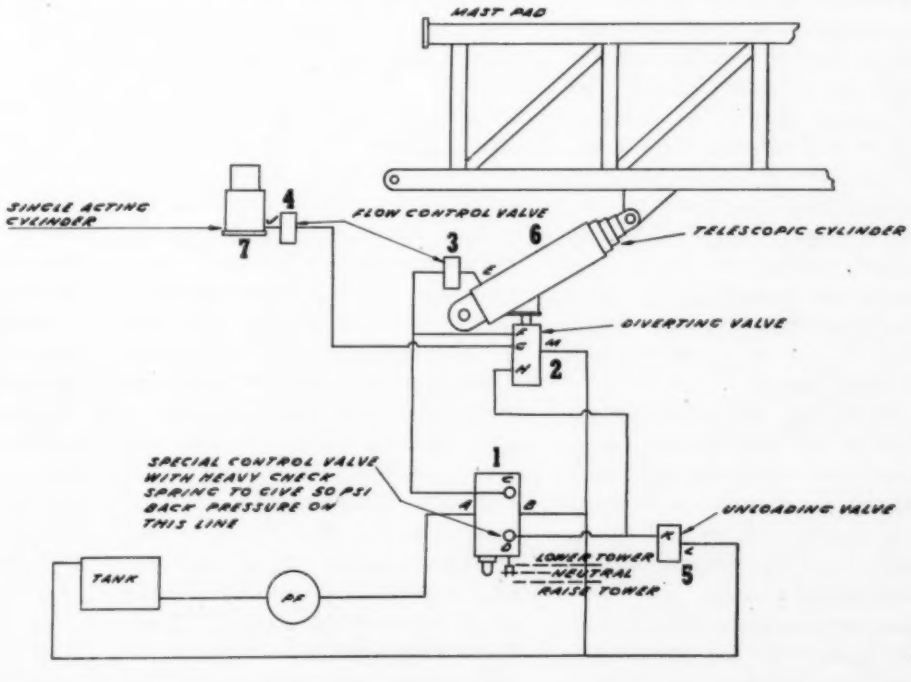


Fig. 4. To lower the mast, the single acting cylinder acts against the mast pad to move the mast over center; the telescoping cylinder retracts to lower the mast into travelling position.

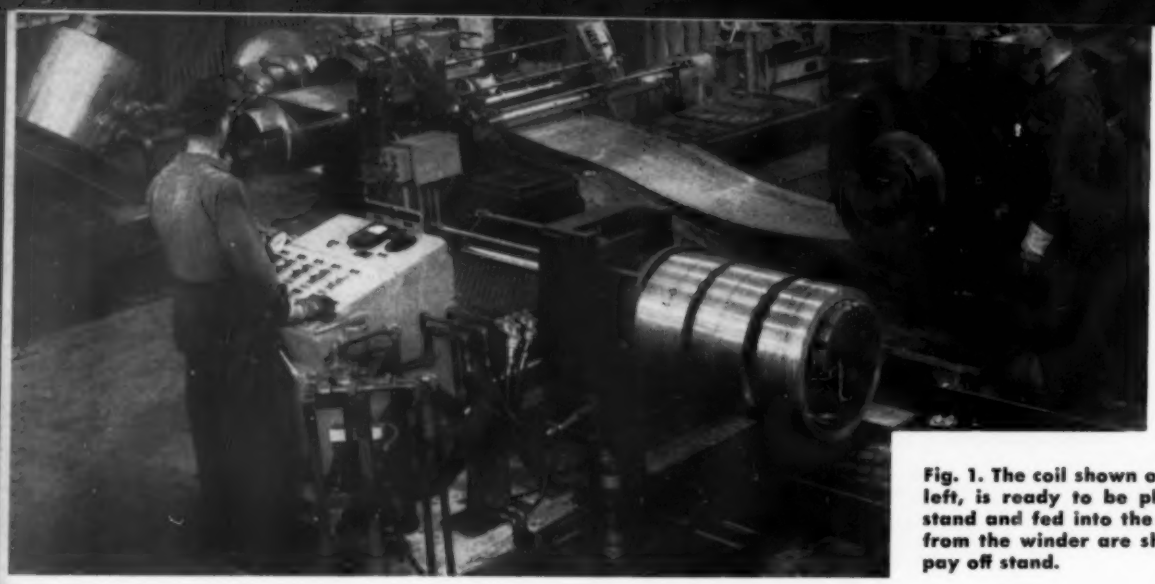


Fig. 1. The coil shown on the downender, far left, is ready to be placed on the pay off stand and fed into the slitter. Finished coils from the winder are shown on the pivoting pay off stand.

Power and Control for Slitter Line

ONE OF SEVERAL HYDRAULICally actuated units in the new Continuous Strip Mill of Scoville Manufacturing Co., at Waterbury, Conn., is the light duty slitter line. Designed to process hard and soft brass up to 1/32 in thick and 30 in wide, in coils weight up to 2000 pounds, a payoff device, slitter and winding reel are driven from a central hydraulic pump by special hydraulic motors. A constant speed 5 hp gear head motor is used for threading and jogging the slitter.

Each unit is adjustable to the required tension for variable material conditions. Strip speed can be controlled through a range of 300 to 1500 feet per minute. After final annealing and cleaning, strip metal is processed through the slitter, where it is cut to customer exact width requirements.

Following the strip through the slitter line, the first unit in line is a hydraulically operated downender, which receives the coils from an infeeding conveyer. This unit places the coil on the payoff stand ready to feed through the slitter.

There are five hydraulic cylinders on the downender, all operated at 500 psi by a double pump having a total capacity of 24 gpm. The cylinders have the following specifications:

Main ram cylinder—2 in bore x 30 in stroke
Traverse cylinder—4 in bore x 36 in stroke
Downender cylinder—4½ in bore x 24 in stroke
Stripper cylinder—2 in bore x 19 in stroke
Bracket stop cylinder—4 in bore x 3½ in stroke

The collapsing block on the payoff stand is a four segment unit mounted with wedges which, through the operation of a standard cylinder, open and close the segment.

The strip moves through a set of rubber covered tachometer rolls connecting to a tachometer generator for indicating strip speed. A small hydraulic pump is part of the equipment controlling strip speed variation in all the units in the line.

Next in line is the conventional pull-through slitter with an overrunning clutch. During the slitting operation, special pull-through tension apparatus preserves edgewise straightness and helps prevent burred edges from forming on the strip. Shears and measuring equipment are provided in the slitter for supplying coil lengths and widths to the customers' exact specifications.

The hydraulically motor driven winder maintains speed and tension during the build up of the coil. Receiving the coils from the winder is the pivoting payoff stand which is positioned hydraulically.

The central pump, a constant displacement piston type, drives the winder motor. The winder motor is a variable displacement piston type with cylinder stroking control. Two small similar pumps, one driven by the central pump and the other driven by the tachometer rolls, control the stroking cylinder of the winder pump, thus maintaining a constant line speed as the coiled metal builds up on the winder mandrel.

A variable displacement payoff motor is pressure compensator controlled to maintain preset pressure, thereby creating a fixed back tension on the strip. A payoff pump which is driven by the central pump drives the payoff motor for threading and acts as a meter for tension control.

A double replenisher pump, vane type, provides 100 psi replenishing pressures to the main system and also provides operating facilities for a stripper cylinder on the winder mandrel.

Simplified hydraulics
for a new lift truck

It's an Old Smoothie!

By C. P. JESSUP
Sales Engineer
Yale & Towne Manufacturing Co.

AN INDUSTRIAL LIFT TRUCK REquires a rugged design which will be maneuverable and versatile. To meet these requirements, the Yale and Towne Manufacturing Co., Philadelphia, Pa., has chosen a hydraulically actuated lift and tilt mechanism for their new standard fork truck.

Simplification is the keynote in this design. When a truck is provided with power units which lift and then tilt the load back into a cradled position for transportation, hydraulic systems provide a compact, easily controlled and maintained design.

The two stage lifting cylinder, which is shown diagrammatically in each position, is the major design feature. One cylinder acts within the other. The outer cylinder lifts to a height of 66 inches before the inner cylinder begins to move up. This combination hoists loads as high as 130 inches.

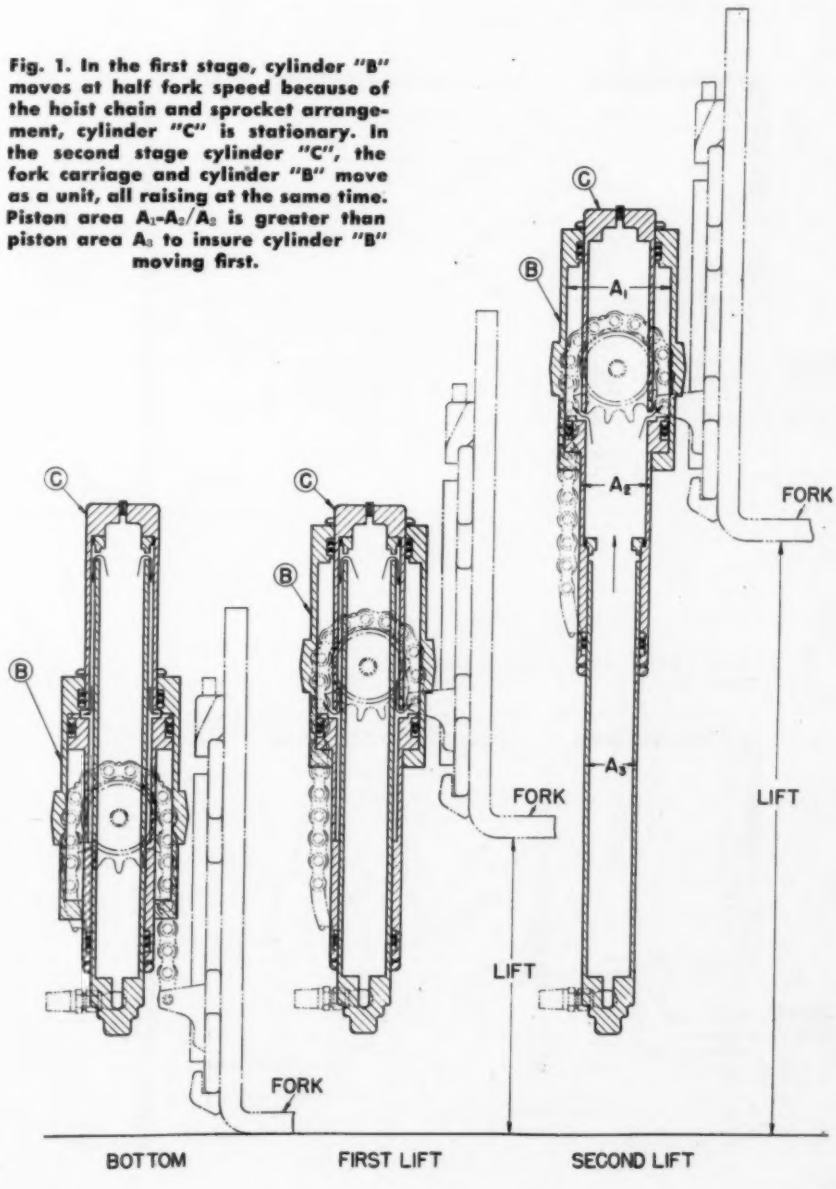
The outer cylinder hoists first because it presents a greater area for the oil to push against than does the inner. The total pressure on it is greater than on the inner cylinder. After the outer cylinder reaches its maximum lift, the inner cylinder lifts, carrying the outer cylinder with it.

Oil pressure in the system, which varies with truck size, is approximately 1000 psi. Standard pumps, valves, hose and packing are used throughout.

The accompanying diagrams follow the flow of oil to accomplish each operation. The diagrams show the simplicity of the system and its components. Maintenance problems are minimized by the use of only one power source. To limit loads to the safe rated capacity of the truck it is only necessary to set a pressure relief valve.

While the tilt cylinders are double acting to obtain forward and backward motion, the hoist cylinder which must raise and lower is single acting. Lowering of the cylinder is accomplished by opening the control valve which allows the weight of the load to force oil back into the tank. Speed of lowering is a function of the valve opening and weight of the load.

Fig. 1. In the first stage, cylinder "B" moves at half fork speed because of the hoist chain and sprocket arrangement, cylinder "C" is stationary. In the second stage cylinder "C", the fork carriage and cylinder "B" move as a unit, all raising at the same time. Piston area A_1-A_2/A_2 is greater than piston area A_3 to insure cylinder "B" moving first.



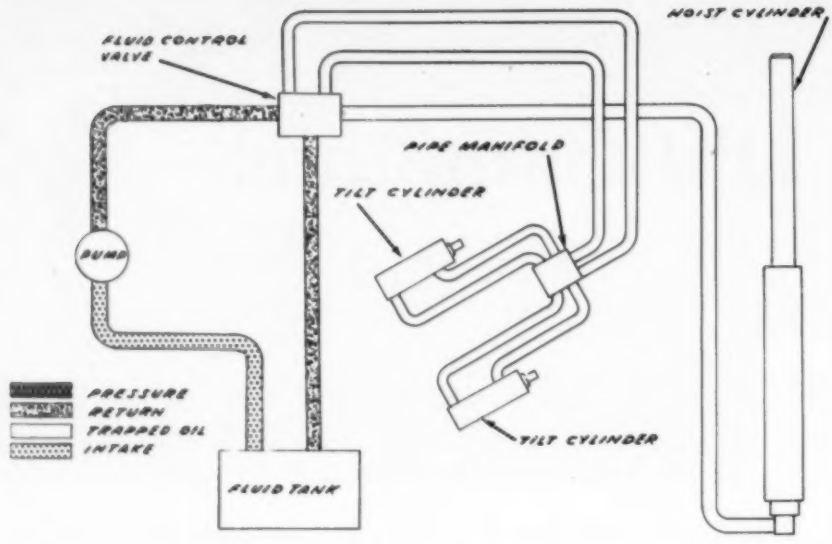


Fig. 2. *Neutral*—With the engine running, oil from the pump is by-passed to the reservoir. Oil from the valve to the tilt and lift cylinders is blocked off to maintain position.

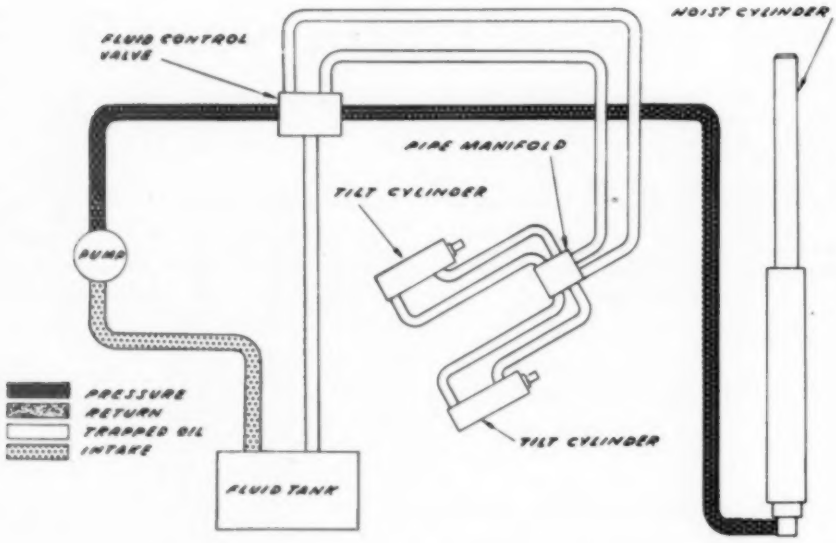


Fig. 3. *Hoist*—Pressure in the line goes from the pump through the valve to the lift cylinder. Oil from the valve to the tilt cylinders is blocked. There is no motion of oil in the line from the valve to the tank. In all operations oil travels from the tank to the pump through the suction line.

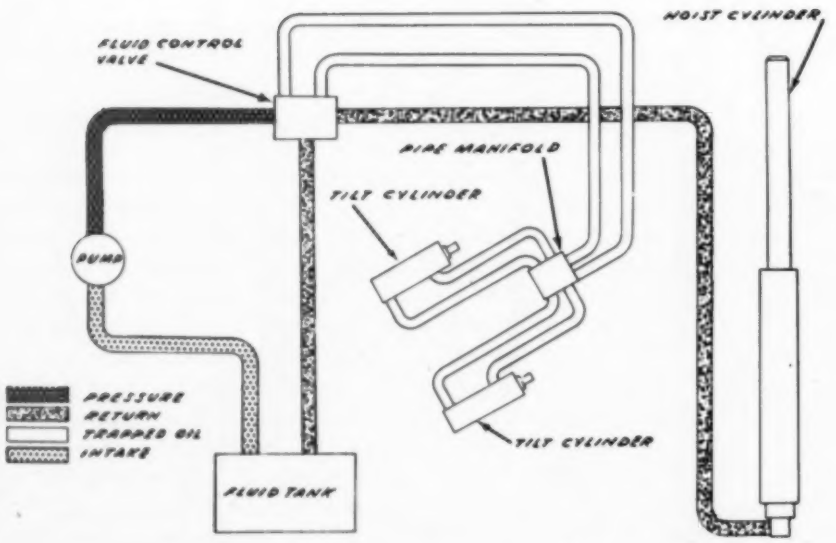


Fig. 4. *Lower*—There is idling pressure in the line from the pump to the valve and blocked oil in the lines between the valve and the tilt cylinders. Oil is pushed from the lift cylinder to the valve and back to the tank by the weight of the load.

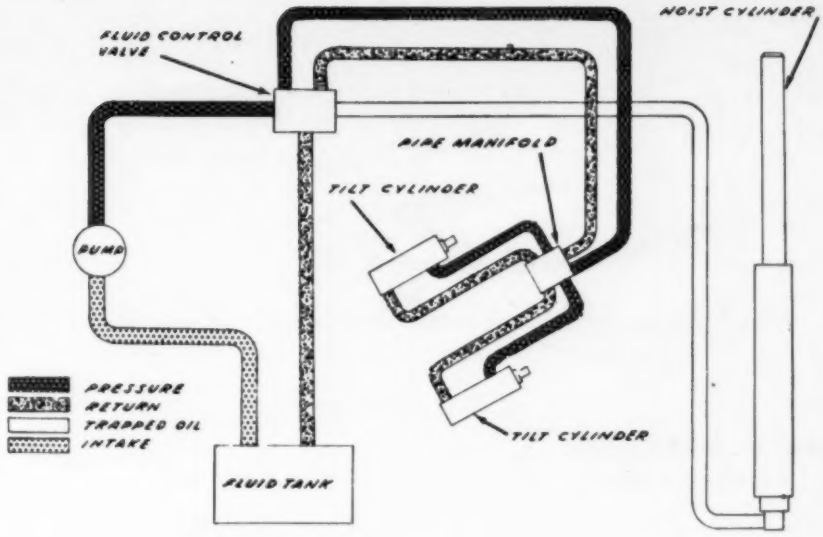


Fig. 5. ***Tilt Back*** **—Pressure is transmitted from the pump through the valve to the rod ends of the tilt cylinders. Return oil travels from the piston ends of the tilt cylinders back through the valve to the tank. Oil between the lift cylinder and the valve is blocked.**

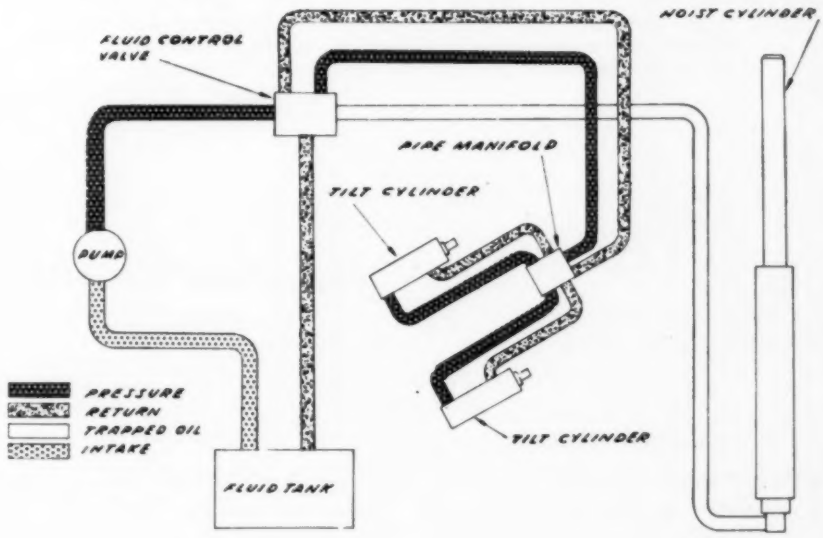


Fig. 6. ***Tilt Forward*** **—Pressure is transmitted from the pump through the valve to the piston ends of the tilt cylinders. Oil between the lift cylinder and the valve is blocked. Oil is drained from the rod ends of the tilt cylinders.**

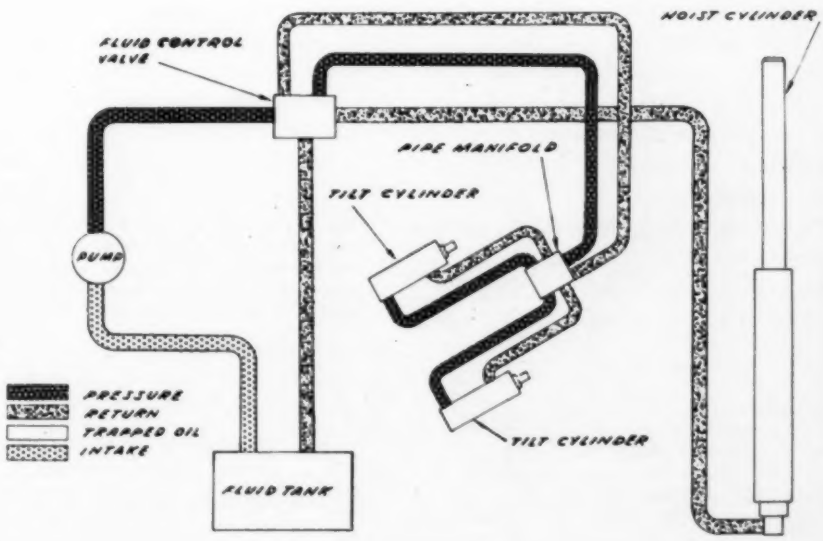


Fig. 7. ***Lower and Tilt Forward*** **—Pressure is transmitted from the pump to the valve and to the piston ends of the tilt cylinders. Return oil moves from the rod ends of the tilt cylinders and from the hoist cylinder, through the valve, back to the tank.**

FRED O. HOSTERMAN
Advisory Editor

Selection and Design of Components For Pneumatic Systems

By J. ALAN CAMPBELL

THE NUMBER AND VARIETY OF pneumatic devices on the market is considerable, yet there is very little literature available to guide the engineer in the proper design or selection of components of pneumatic systems.

Four basic elements make up most pneumatic devices. These are orifices, volumes, valves and pistons or diaphragms. The orifice is used to restrict flow or dampen wave motion. Used with a volume, it acts as a timing device. Other functions of volume are for storage, or to offset leakage or displacement effect upon pressure.

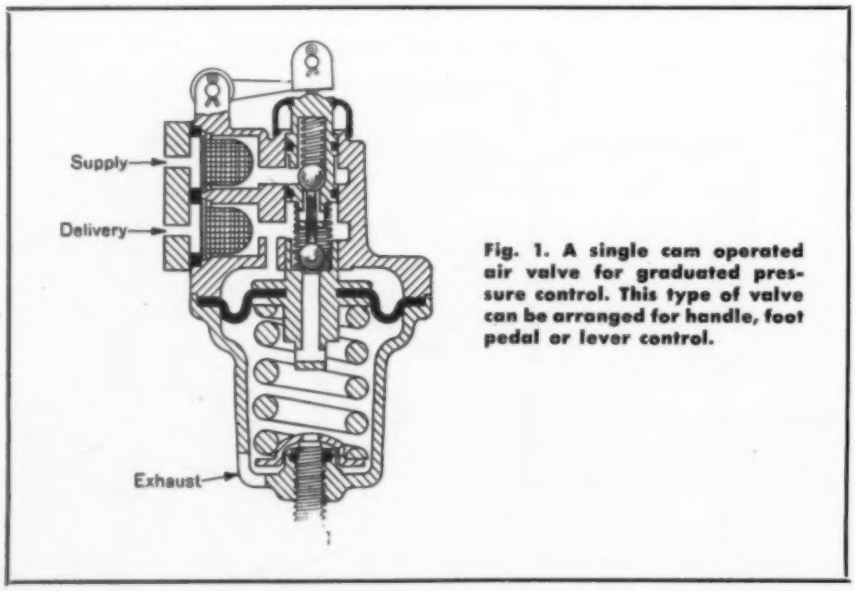


Fig. 1. A single cam operated air valve for graduated pressure control. This type of valve can be arranged for handle, foot pedal or lever control.

There are many varieties of valves, the most common being:

(1) Ball—self-aligning, good sealing and easily cleaned;
(2) Disc—specially suited to high pressure;
(3) Wing—good general purpose, easy to maintain;
(4) Slide—for multiple-port infrequent operation;
(5) Rotary—particularly suited for multiple-port construction; and
(6) Piston—widely used, though particularly suited for hydraulic fluids.

Pistons and diaphragms are the work-producing elements of pneumatic devices. Pistons with cupped packings or "O" rings are used in a wide variety of diameters and strokes. They are versatile as to application, though rubber diaphragms are preferred if friction is an impor-

tant factor. The greatest limitation of diaphragms is the limited stroke available. This is particularly true of metal diaphragms.

Senders and Receivers

The pneumatic devices built from the above elements can be classed as Senders, Receivers and Intermediate Devices. The simplest sender is an open or shut device like the common plug cock. Poppet valves, diaphragm valves and rotary valves are also widely used for senders of this type.

One of the most important types of control valves or senders is the pressure control valve, often called a metering valve. It consists of a floating mechanism so designed that its delivery pressure is proportional to the position of the operating handle. As an illustration, the operating handle position might be calibrated in psi of delivery pressure. Figure 1 shows a typical single valve, cam operated, used for pressure control. This type of valve can also be arranged for handle, foot pedal or lever operation.

There are many other types of senders which are frequently combined so that one or more valves are under the control of a single handle.

The conventional air cylinder is the best known receiver or power device. Others in wide use include the diaphragm chamber, actuator, three-position cylinder, rotary air motor and positioner. The positioner is a power cylinder which will assume any position in response from the sender and maintain this position independent of the external force within its power range.

Intermediate Devices

The intermediate devices include a variety of direct and reverse acting relays, quick release valves, application valves and others. These can perform such functions as permitting small control valves to pilot receivers that require large volumes of air. They can be arranged to establish sequence of functions, timing, delay action and other interlocking of various functions.

In selecting devices to build up a control system, there are several general guides that can be useful. Although there are systems operating at pressures from 5 psi to 1500 psi, the maximum pressure generally used is about 80 to 100 psi. There is a much wider selection of devices in this pressure range.

It is usually economical to select control devices of a size corresponding to ¼ in iron pipe size or ⅜ in OD tubing. In selecting the receivers or actuating devices, it is first necessary to determine the power required, number of positions, accuracy of positioning, frequency and speed of operation. After the nature of the receivers is known the senders are selected. Their selection depends on such questions as the number and type of functions involved. Is control to be automatic, manual, single-handle control? Are float, cam, electric or thermal senders required? The intermediate devices are then selected to interlock various functions, increase speed, increase capacity, insure sequence, create time delays, provide automatic shutdown, etc.

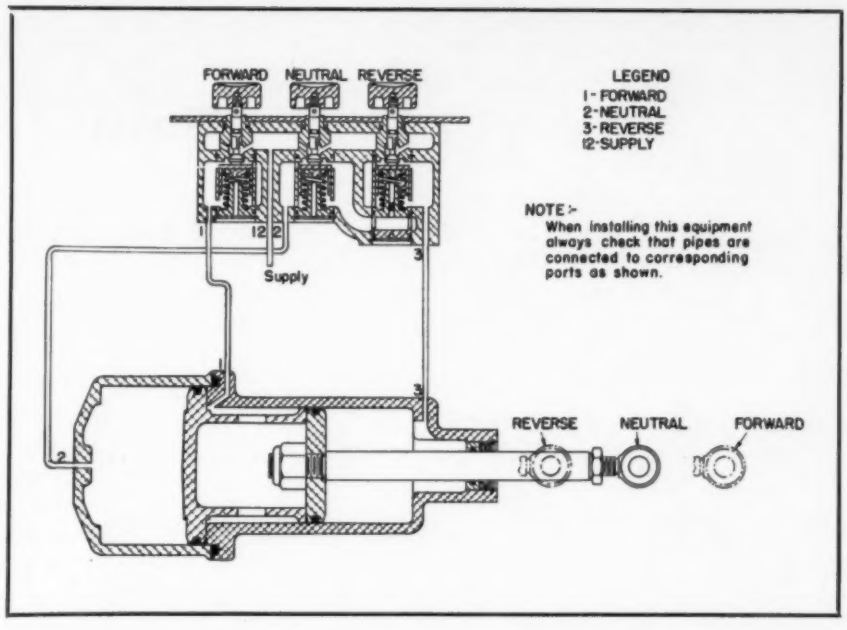


Fig. 2. A push button clutch for marine and industrial use. A three position power cylinder with standard remote controls is shown. The large cylinder on the end of the double acting cylinder acts as a center position stop.

Remote Control

Examples of pneumatic remote control range from the simple on-and-off valve, which operates an air cylinder for a clamp or press; to the railroad air brake, where a brake valve on the locomotive pilots the brake equipment on 150 cars in a train more than a mile long. A single pipe the length of the train is used to supply air to the storage tank on each car and to transmit the signals to the valves on each car, which in turn, will apply the car brakes in any desired degree.

Other uses for pneumatic remote controls are for operating throttles, clutches, brakes and shifting gears on oil well rings and marine engines. Figure 2 illustrates a push button clutch for marine or industrial use. Pneumatic controls are adaptable to many material handling problems to control conveyor speeds, open gates or position valves. Many process industries use pneumatic equipment for remote control of burners, valves, weighing devices and fluid level controls.

Compressed air is a flexible and adaptable medium for control. A more complete knowledge of pneumatics and an understanding of existing pneumatic equipment can go a long way toward the proper application of pneumatic devices and the successful design of control systems.

This is the fourth in a series of resumes of papers delivered at conferences held by the Committee on Hydraulic and Pneumatic Systems, sponsored by the Southern California Section of ASME, ASCE, IAS, ARS and AIEE.

Constant Flow Regulator

By JOHN R. McGUIRE

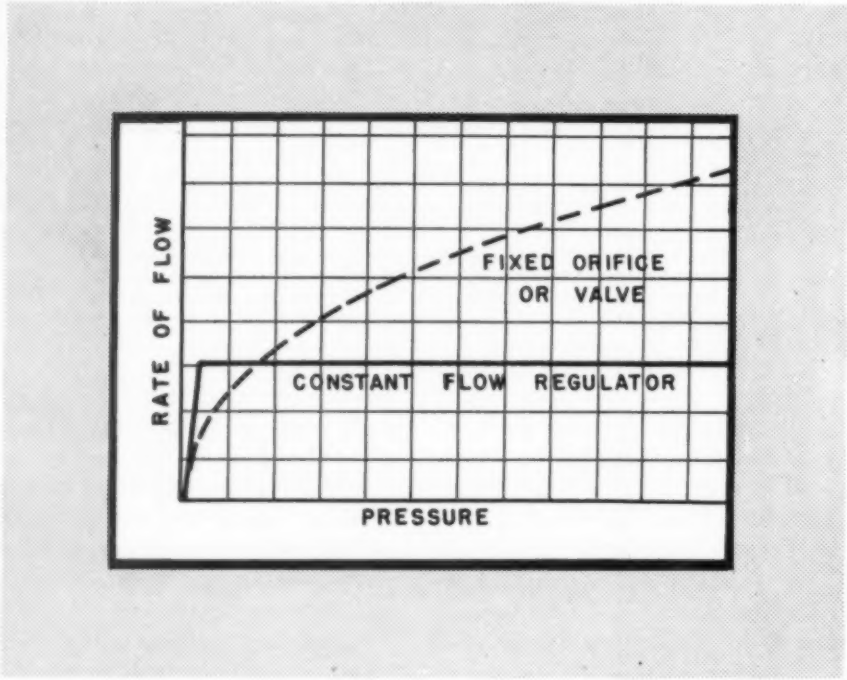


Fig. 1. The rate of fluid flow varies as the square root of the pressure differential across a fixed orifice. Pressure differential does not effect the rate of flow through a constant flow regulator.

WHEN HYDRAULICALLY POWER was first applied to aircraft, the system consisted of a hand pump, control valve, cylinder, and various fittings and tubing. Today, the hydraulic system is highly complex and is used for both surface and flight control in addition to supplying power for accessories.

The trend in aircraft design is to larger, faster and more powerful planes, and the hydraulic system has been subjected to higher and higher pressures to meet the ever increasing demand for hydraulic power and still remain within weight limitations. Prior to World War II hydraulic pressures ranged from 600 to 1000 psi. This was increased to 1500 psi and the modern designs of today operate on 3000 psi pressure. Research is being carried on at present to determine the feasibility of going to a 5000 psi system.

This increase in pressure has accentuated the problem of controlling the speed of the various accesories, as it is obvious that they will move

Figure 2

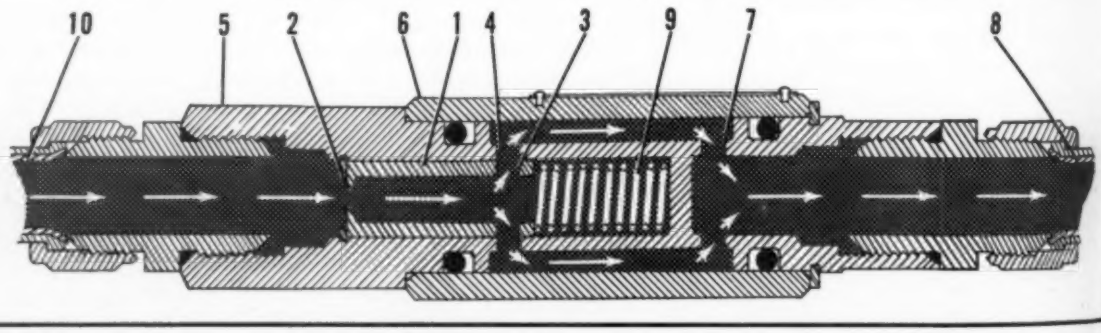


Fig. 2. In normal operation, fluid flow passes through the orifice, into the piston and out to the component line through unrestricted ports.

Fig. 3. Metering of the fluid flow occurs when the pressure drop across the piston orifice becomes great enough to move the piston against the spring. This action varies the port size to maintain constant flow.

...ton Aircraft Hydraulic Systems

at a speed limited only by restrictions to flow in the hydraulic circuit and by the volume of fluid required unless some means of regulation is used.

In the past almost all speed regulation was accomplished by the use of fixed orifice restrictor valves and this method is still satisfactory where both system pressure and back pressure induced by the work being done remain fairly constant at all times.

However, with modern air speeds, load conditions of various accessories often vary over a wide range. For regulation under such conditions valves known as constant flow regulators are now used. The basic difference between these and fixed orifices is that with the latter the rate of fluid flow varies as the square root of the pressure differential across the orifice, while with the former the flow rate is maintained approximately constant regardless of upstream and downstream pressure. These characteristics are illustrated by Figure 1.

An example of a typical installation of a constant flow regulator is in the steering control of an aircraft nose wheel. In this application it is desired to meter fluid to the steering gear actuating cylinder at such a rate as to preclude abrupt turning of the nose wheel. The regulator permits an even, rapid turn consistent with the requirements for safe operation.

Another example is the control of an aircraft dive brake. With the tremendous air loads imposed it would slam shut with such force as to require excessively heavy and sturdy stops. A constant flow regulator allows it to close at the maximum safe speed regardless of the magnitude of the air load.

Figures 2 and 3 show the flow diagrams of one type of constant flow regulator used quite extensively in aircraft. With reference to Figure 2, fluid entering the regulator impinges against the face of a piston containing a sharp edged orifice (2). In normal operation, the fluid passes through the orifice into the piston and is exhausted through the slots (3) in the skirt and ports (4) in the body, to the annulus formed by the body (5) sleeve (6). Larger ports (7) in the body exhaust the regulated fluid to the component line (8) to be service. As flow increases, regardless of whatever pressure might be imposed, the pressure drop across the piston orifice also increases. Pressure drop, which is a function of rate of flow, is completely independent of the hydraulic system pressure. When the pressure drop reaches the point where the piston is pushed inward to compress the spring (9), the fluid flow is metered through the slots (3) in the piston skirt and body ports (4). The piston movement restricts the opening between the piston skirt slot (3) and the body ports (4) resulting in a constant rate of fluid flow into the regulated flow line (8). When piston movement occurs, it is apparent that flow will be metered at a rate equal

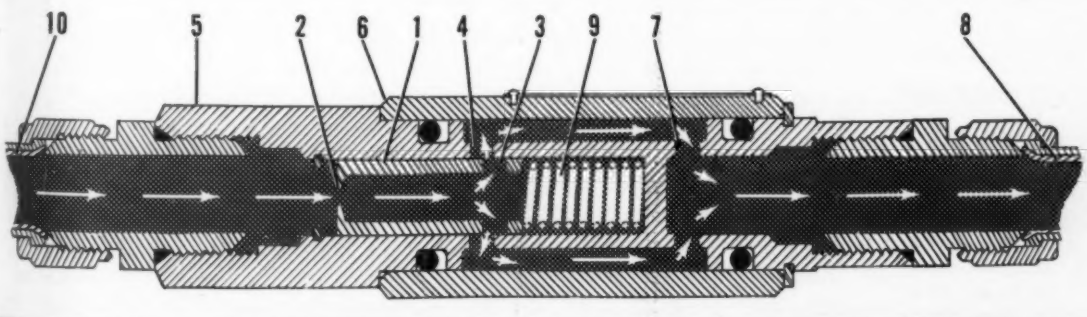


Figure 3

FLOW RATE G. P. M. (AT 3,000 P.S.I.)	FIXED RESTRICTOR ORIFICE DIA. (APPROX.)	CONSTANT FLOW REGULATOR ORIFICE DIA. (APPROX.)
.5	.019	.053
1.0	.027	.076
1.5	.034	.093
2.0	.038	.107
5	.061	.170
10	.086	.240

Fig. 4. For a given flow rate the constant flow regulator offers a diameter many times larger than the fixed restrictor regulator, thereby reducing the danger of clogging.

to that which will cause a pressure drop through the piston orifice, which will exactly balance against the piston spring. Flow in the reverse direction is uncontrolled.

One outstanding advantage of the constant flow regulators is that speed of actuation can be determined within close limits prior to test flight. Without constant flow regulators sped of actuation can be determined only during test flight. This is particularly advantageous to the aircraft designer who today is working with increasingly complex hydraulic systems.

Orifice Comparison

In Figure 4 a comparison is made between the size of control orifice required for given flows through a constant flow regulator and a fixed restrictor valve. It can be seen that the orifice in a constant flow regulator is many times larger than that used in a fixed restrictor valve. The danger of clogging is less in a constant flow regulator due to the larger orifice used.

From the foregoing it will be apparent that consideration should be given to both fixed orifices and constant flow regulators for each separate installation. Where system pressure and back pressure imposed by the work being performed are fairly constant, or where a large variation in operating speed is not objectionable, a fixed orifice restrictor valve should be used as its construction is more simple. Where a variation in speed of actuation is objectionable or hazardous, a constant flow regulator should be used.

ADVERTISERS' LITERATURE

(Continued from page 10)

A-16. ROSS OPERATING VALVE COMPANY. Complete details of the Ross In-Line Master valve are contained in Bulletin 302.

A-17. SUNDSTRAND HYDRAULIC DIVISION. Engineering data sheets, AH 55, provide complete dimensions, mounting information and capacities for Sundstrand multiple section valves.

A-18. TOMPKINS-JOHNSON CO. T-J air and hydraulic cylinders, cushioned and non-cushioned types, 100 to 50,000 pounds, are described in available catalogs.

A-19. VALVAIR CORPORATION. Bulletin A-H describing the variety of interchangeable control assemblies for a standard valve body is offered.

HYDRAULIC COMMITTEE MEETINGS

THE SAE A-1 COMMITTEE ON AIRCRAFT Pumps, under the chairmanship of J. Milton Kidd, hydraulics engineer, Glenn L. Martin Co., held their semi-annual meeting April 18 at the Park Sheraton Hotel, New York City.

Discussion centered around three new pump specifications. On the basis of a very extensive survey conducted by Frank W. Murphy of Douglas Aircraft, the committee was able to recommend final action on the specification for electric motor driven hydraulic pumps. The specification covers the basic requirements for all pumps of this type.

Specifications for hydraulic motors and for variable volume hydraulic pumps were also discussed. The key discussion was whether the specifications should be written around types currently available or types that might be required in the near future. It was finally agreed to follow the latter course. General agreement was reached on objectives for future units in these classifications. The committee expressed their appreciation to Kenneth Postel of Vickers Inc., for his excellent work on the preliminary drafts of both specifications.

Carl L. Sadler of Sundstrand Machine Tool Co., presented the preliminary draft of a standardized procedure to be used in pressure pulsation testing of hydraulic pumps.

THE SAE A-3 COMMITTEE ON AIRCRAFT Fittings and Hose Assemblies held a two day meeting at the Park Sheraton Hotel, New York, on April 17 and 18, under the chairmanship of L. J. Henderson of the Weatherhead Company.

Among more than twenty items on the agenda that claimed the greatest attention was the item concerning the type of gasket for use with straight threaded fittings in engine fuel and oil systems. Previously this problem was restricted to those few applications where full size "O" rings are used; however, it was pointed out that the standard "O" ring seals developed for use with aromatic fuels were of the improper size for use with standard straight threaded fittings now coming into wide use. This item was finally referred to the Services.

Of particular interest was the discussion regarding the problems involved with fittings for line sizes from 2 to 4 in OD, now being incorporated into new aircraft. Airframe manufacturers indicated they could not afford the weight nor the space required for standard flare type fittings; the Service representatives pointed out they had no wrenches for such fittings and that space available in modern aircraft was insufficient for proper manipulation of so large a tool.

The committee discussed various types of couplings proposed as a substitute in these sizes and a project was established to survey the industry in an effort to establish a set of requirements for a new series of fittings to fulfill this urgent need.

R. N. Stickney of the Aeronautical Standards Group reported on the status of the new hose specifications for both high pressure and medium high pressure ranges. He reported the new specifications about ready and would be released shortly.

Seminar Series Concludes

The series of six meetings devoted to the practical application of hydraulic and pneumatic systems in industry was concluded on May 31, when a panel of three speakers addressed the Committee on Hydraulic and Pneumatic Systems on "Practical Applications of Hydraulics to Oil Well Pumping Equipment". The seminar was held in the auditorium of the General Petroleum Bldg., Los Angeles. The speakers: C. J. Woodard, coordinator of design and manufacturing; I. M. White, manager of engineering; and D. P. Billings, section design engineer, all of The Pelton Water Wheel Company, covered a number of modern applications of hydraulic theory and a variety of hydraulic equipment recently introduced for oil well pumping.

The fifth meeting in the series was addressed by Dr. Peter Kyropoulos, chairman, Hydraulics Division, A.S.M.E. and assistant professor of mechanical engineering, Cal Tech on April 5 on the subject, "Hydrodynamic Power Transmission for Automobiles".

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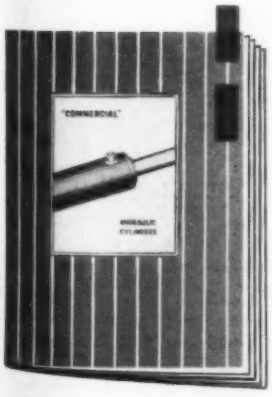

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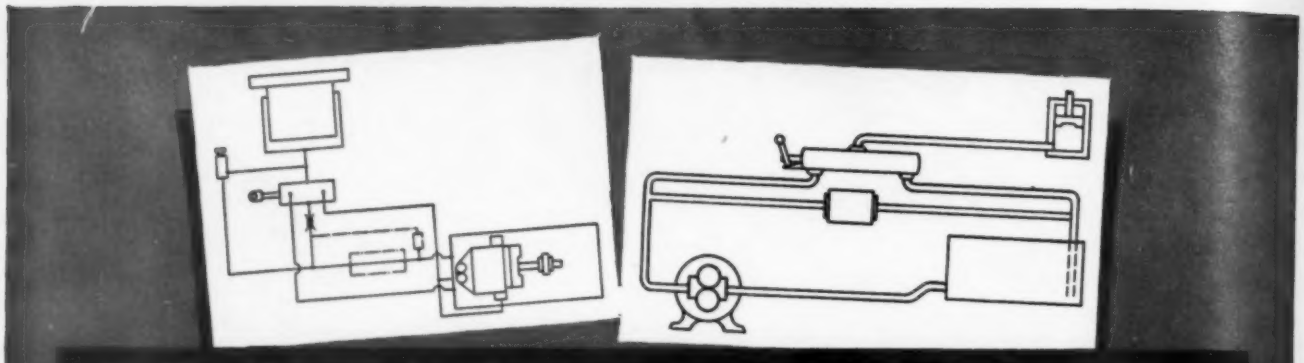

A Beginner's Course in Basic Hydraulics

CHAPTER VII

DIRECTIONAL VALVES

Part 1

Introduction

DIRECTIONAL VALVES CONTROL OR direct the flow of liquid in hydraulic systems to the points of work application. Normally of spool type piston design, the valve may be used for example, to perform a work operation by driving a piston back and forth in its cylinder. A directional valve whose movable parts change position so as to alternately introduce and drain off liquid from each end of the piston cylinder would make this possible.

Directional valves may operate hydraulically by differences of force set up on opposite sides of their movable parts, or they may be positioned by hand, by mechanical means or by electric power. Sometimes two or more methods of operating the same valve will be utilized in different phases of its action.

The commonest used directional valve—a four-way valve—has four pipe connections; one from the pressure sources, a second from or to the reservoir and two others connected to the cylinder or other work unit. Two- and three-way directional valves as well as six-way, eight-way and other multiple port valves are in use.

Directional valves are of two designs—spool and rotary. In the spool design which we will discuss first, a specially shaped sliding piston opens and closes passages through the valve as it is moved back and forth in its cylinder. In the rotary design a round block or core is rotated inside a sleeve. Recesses and passages in the block make the desired connections between passages in the sleeve, which lead to different parts of the system. Valves of each of these designs will be discussed in detail.

Spool Directional Valves

Two-way valves. The open and closed positions of a two-way sliding valve are shown in Figure 87. In the open position liquid enters through one port, passes along the small axis or hub of the spool and leaves through the other port. The piston of the valve of Figure 87 cannot move back and forth by differences in hydraulic pressure set up within its cylinder, since the forces are in balance. As indicated by the arrows against the piston heads, the same pressure acts on equal areas on their inside faces; and when the input passage is blocked, the piston blocking it is acted on all around its circumference by the same pressure.

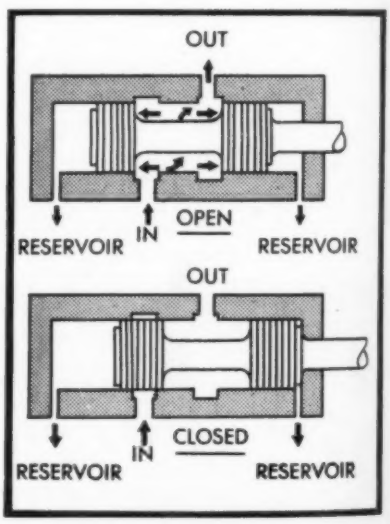

Fig. 87. A standard two-way control valve. Drain openings and lubrication grooves are shown; the arrows in the open position drawing illustrate hydraulic balance.

A number of features common to most spool type valves can be noted in Figure 87. The drain openings at either end of the cylinder are needed

(Continued on page 30)

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(Continued from page 28)

so that back pressure will not be built up in the cylinder to hinder movement of the piston. When spool valves become worn they may lose balance because of greater leakage on one side of a spool than on the other. In that event the piston would tend to stick. Small grooves are for this reason machined around the sliding surfaces of the spools, so that leaking liquid will encircle the spools and keep them lubricated and centered.

Two-way standard control valves are furnished with normally open or normally closed plunger, plain or spring return and for mechanical, hydraulic, electric (solenoid) or electric pilot-operated control.

Three-way valves. Figure 88 illustrates a basic design of a three-way valve. In a valve of this type any two ports may be connected while the third is blocked in any one operating position. Figure 88 shows ports 1 and 3 connected with port 2 blocked. With the spool in the center position, ports 1 and 2 are connected and port 3 is blocked; when the spool has moved to the right, port 1 is blocked and ports 2 and 3 are connected.

Four-way spool valves. This is, as previously indicated, the most widely used directional control valve. In a typical installation, the valve connects with four separate pipe lines: (1) one connects the valve to the pump; (2) another connects it to the reservoir by means of two exits from the inside of the valve; and (3) the other two connections are to either end of the cylder or work unit.

As the piston of the four-way valve is moved back and forth, each end of the work cylinder is connected in turn with the pressure line from the pump, while the other end of the work cylinder is connected with the reservoir. This enables the work piston to be driven back and forth without meeting hydraulic resistance.

Figures 89, 90 and 91 show how a four-way valve works. In Figure 89, the piston of the valve is at its right extremity in its cylinder. Liquid from the pump flows to the right end R of a work cylinder, while liquid from the left end L of the cylinder is being returned to the reservoir. In Figure 90, with the piston at its full left position in its cylinder, flow is reversed and liquid from the pump flows to the left end of the work cylinder, while liquid from the right end is being returned to the reservoir. In Figure 91, with the piston in an intermediate position, flow through the valve from the pump is shut off and both ends of the work cylinder can drain to the reservoir unless other valves are employed to control the flow.

Since this valve is often used to drive a work piston as described, it is sometimes called a reversing valve. The piston of the directional valve itself can be positioned in a number of ways: manually, e.g., by a lever; mechanically, as by the action of a cam brought into position at the proper moment by the work operation; mechanically by means of gears and shafting; electrically, in a variety of ways; or hydraulically through the action of a pilot valve. Rotary directional valves are often used to position spool valves.

Figures 89, 90 and 91 illustrate a four-way valve designed to be operated by a pilot valve. The pilot valve alternately delivers pressure at one end and then to the other of the cylinder of the valve, in exactly the same manner as the reversing valve might be used to drive a work piston. In Figure 89, for example, the pilot valve would stop delivering pressure to the left hand end of the piston and would begin delivering pressure to the right hand end, thus reversing the position of the valve piston.

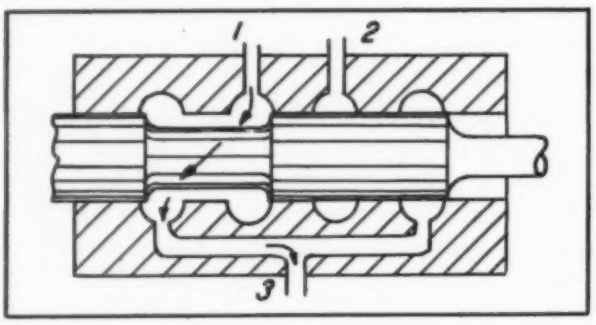

Fig. 88. A three-way valve with the piston in retract (left) position, ports 1 and 3 are connected and port 2 is blocked. In each of three operating positions two ports are connected and the third blocked.

Figs. 89, 90 and 91. These drawings show how a four-way valve works. In Fig. 89 the valve piston is at the right end of travel, liquid from the pump flows to right end R of work cylinder, liquid from left end L is open to drain; in Fig. 90 flow conditions are reversed; in Fig. 91 the piston is in an intermediate position, pump flow is shut off and both ends of cylinder drain.

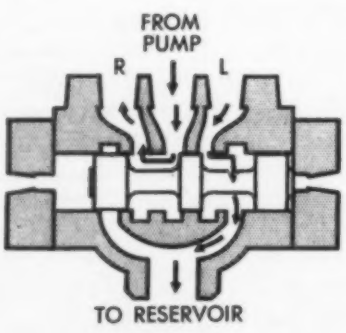

Fig. 89.

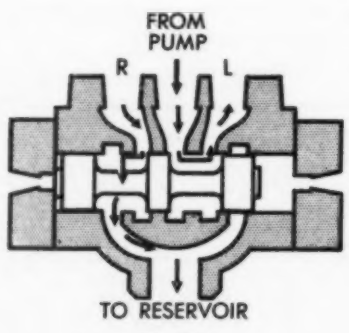

Fig. 90.

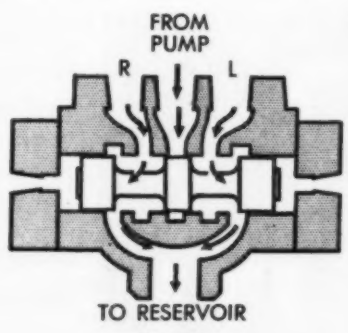

Fig. 91.

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Useful Literature

The publications listed are available without charge. Mark the initial key number on the card bound in this issue and mail.

27. Electroaire Valve . . . Described in The Bellows Co. Bulletin AU 250, this valve provides electrical control for air powered equipment. This air powered, compact valve is controlled by a solenoid which directs the incoming air to shift the slide valve. The low, 6 watt at 8 volt operation permits placing the transformer at a safe-remote location. Other than stopping the valve, a short circuit at this voltage would not damage the equipment. A schematic wiring diagram and mounting drawing are included. The valve which is available in ¼, ⅜ and ½ in port sizes provides a large power to load ratio.

28. Hydraulic Cylinders . . . Catalog H-47, issued by Tompkins-Johnson Co., describes their line of hydraulic cylinders. Models for use in 750 and in 1500 psi ranges in sizes from 1½ to 8 in dia are shown in non-cushioned and both adjustable and non-adjustable action types. Illustrations show the construction features of the available styles. Charts present the relationships between cylinder areas, powers and weights. Nomographs for computing pump delivery, velocity, displacement and force are included.

29. Gasket Mounted Valves . . . Design, engineering and performance data of Sunstrand Machine Tool Company's gasket mounted valves are published in bulletin DN-46. Solenoid pilot valves, directional control valves and pressure control valves are completely detailed. All units are designed to conform to JIC Standards. Applications, mounting positions, flow capacity and pressure ranges are listed.

30. Axial Plunger Pumps . . . A 4-page illustrated folder describing the "Electraulic" axial plunger pumps is available from MacMillin Engineering Corporation. These pumps, particularly suitable for heavy tonnage extrusion, forging and deep draw presses, are employed for pressure ranges from 2000 psi to 9000 psi. A longitudinal section illustrates the swashplate drive mechanism, the two capacity high pressure plunger pump and the low pressure, gear type booster pump which make up the unit. Design details are described and illustrated in detail. A chart indicates the operating speeds, capacities and pressures of the available types of pumps.

31. Aluminum Body Air Cylinders . . . In a booklet describing cost cutting methods and equipment, the Cushman Chuck Company offers a new high speed aluminum body air cylinder. The unit is made to perform at speeds up to 6000 rpm. Large air ports permit rapid movement, speeding up chucking of work pieces. A pressure balanced air seal maintains jaw pressures.

32. Remote Control . . . Hydraulic remote controls for industrial use are described by Bulletin 20-105 issued by Sperry Products, Inc. Two series of controls and available accessories, including intermediate transmitter for use at secondary control stations, are described. Features include use of a single line up to 200 feet long for connecting transmitter and receiver, balance is obtained by use of opposing springs. Force applied to the transmitter handle is immediately delivered to the receiver lever for useful work.

33. Pump Packing . . . A catalog sheet, offered by Johns-Manville, illus-

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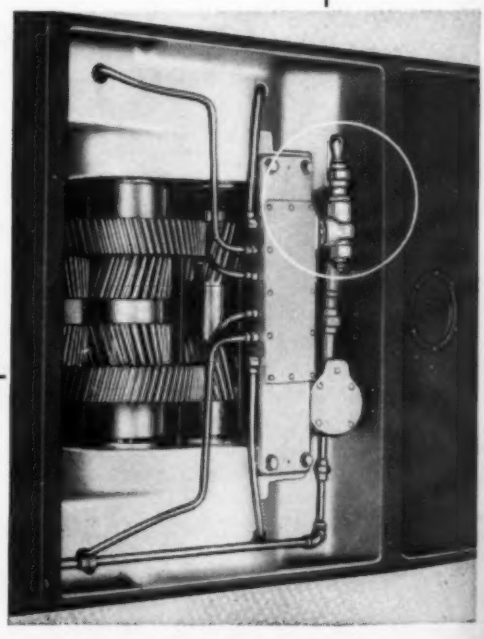

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trates their pump packing recommendations. Ten styles of packing, their materials, available sizes and specific applications are described. A chart lists the recommended packings for centrifugal and reciprocating units in a variety of service conditions.

34. Pressure Reducing Valve . . . Operation and maintenance instructions for the H-3 Controlair are given in a four page bulletin issued by the Westinghouse Air Brake Co. The unit is a self-lapping, automatic pressure reducing valve of the cam operated type. Diagrams show how delivery pressure is maintained and adjusted. An exploded view of the valve identifies parts for maintenance and repair.

35. Air Cylinders . . . The complete line of Lindberg air cylinders is described and illustrated in a new 16 page Bulletin 731. A feature of these cylinders includes one piece piston with synthetic "Vee" packings which simply snap into the piston groove. Multiple position cylinder ports and the absence of the tie-rods are also two of the many design features of these cylinders. Manufactured in six mounting types, Lindberg standard double acting air cylinders come in eleven bore sizes from 2 to 12 in.

36. Hose Couplings . . . Snap-tite, Inc. has prepared a folder of bulletins and price lists. Engineering data for hose couplings and nipples in a size range of ¼ to ¾ in is presented. The data includes flow capacities for pneumatic and hydraulic operation and pressure, tensile and wear characteristics. A variety of applications are illustrated.

CIRCLE NUMBERS ON THE CARD AND MAIL!

37. Teflon Gaskets . . . The properties of Teflon as a gasket material are discussed in an application sheet of the United States Gasket Company. Its high resistance to heat and abrasion and its complete chemical inertness make Teflon applicable for chemical-proof packings. Teflon jacketed gaskets are fabricated in a wide variety of forms and core materials.

(Continued on next page)

PRP Corp. Plant Enlarged

The opening of a new addition to the plant of Precision Rubber Products Corporation, of Dayton, Ohio, provides a separate plant for milling and compounding and practically doubles the previous production volume, according to H. G. Taylor, president, PRP Corporation. New press equipment, electrically operated and heated, provides the most modern manufacturing facilities. The only plant in the industry entirely equipped with electrically heated platens, PRP Corporation believes the resulting advantages in manufacturing control to be very important in achieving and maintaining uniform quality.

The separate milling and compounding plant keeps raw materials away from the rubber plant, an additional safeguard that assures minimum processing difficulties, highest reliability and maximum operating life for "O" rings. The new facilities are expected to maintain service to an expanding number of users. PRP Corporation, an approved AN supplier, makes a wide range of "O" rings from .02 ID, .030 cross section to 24 in OD, ½ in, with distribution through branches and distributors.

One of the press lines in the PRP Corporation plant.

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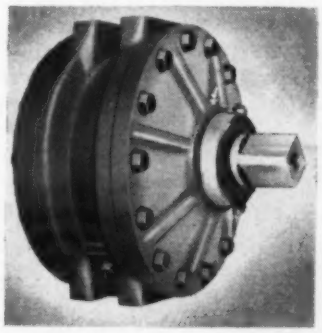

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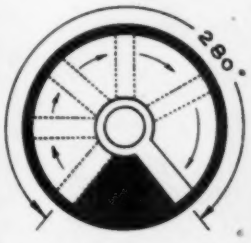

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38. Release Valve, Rotorseal . . . A self adjusting quick release valve which provides a positive means for discharging air under pressure from any system where it is necessary to quickly evacuate air under pressure is described in Fawick Airflex Bulletin 299. Operating on the principle of pressure differential, a five pound differential actuates a discharge plunger opening the exhaust port and exhausting to atmosphere. Also described is the rotorseal, a single passage seal for applications where large volumes of air, gases or liquids are required. The seal operates at high speeds in either direction, sealing is effected by a non-metallic bushing held against a spindle face by spring pressure.

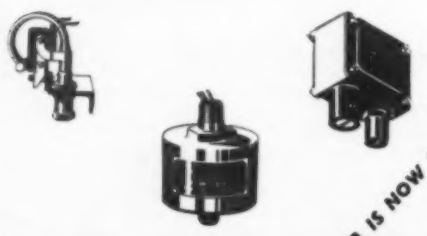
39. Mechanical Seals . . . Bulletin 49 describes Byron-Jackson Co. seals which are designed for sealing stuffing-boxes in centrifugal pumps handling hot and cold liquids, either corrosive or non-corrosive. Applications are presented for three types of seals: a low pressure, single seal; an oil lubricated, high pressure double seal; and a balanced high pressure single seal. Maintenance suggestions are given for refinishing and installation of seal faces.

40. Oil and Grease Systems . . . Service tips, and installation procedure are included with the description of Trabon type M and MX oil and grease systems in Bulletin E463, issued by Trabon Engineering Corporation. Centralized lubricating systems provide a means of greasing and oiling all bearings on one or several machines from one central point. The lubricant is pumped automatically or manually from the central pumping point to the feeders located on the machinery. The feeders measure and distribute the lubricant to the bearings. Along with dimensional diagrams an example of planning a lubrication system is presented.

41. Pneumatic Vibrators . . . Catalog 105 describes the products of the Cleveland Vibrator Company. Technical data on vibrators, valves, and fittings provide dimensional and operating characteristics. Vibrator applications for foundry equipment, material handling and vibrator tables are illustrated. Speed and intensity of vibration is controlled by the size of the piston and the air pressure. Depending on the size and application of the vibrator, air pressure may be between 20 and 100 psi. A cutaway drawing displays the operating principle of the vibrator.

CIRCLE NUMBERS ON THE CARD AND MAIL!

42. Air Cleaner . . . Donaldson Co., Inc., describe their Micro-Mesh air cleaners in catalog sheet 29A. For use on air compressors, air cylinders, air presses and small engines, the filter can be supplied in six sizes ranging from 2¾ to 4 9/16 in diameter. The copper mesh, oil-wetted, filter element is placed in the cleaner body under slight compression so that it will not break down, shift or sag.



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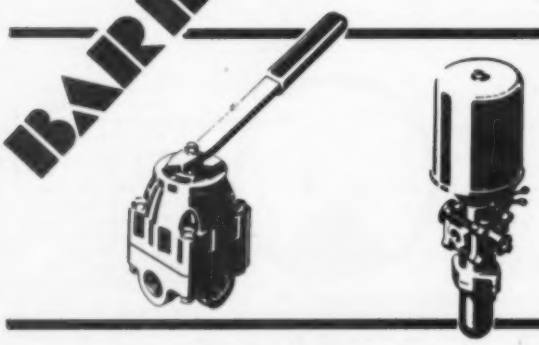

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New PRODUCTS

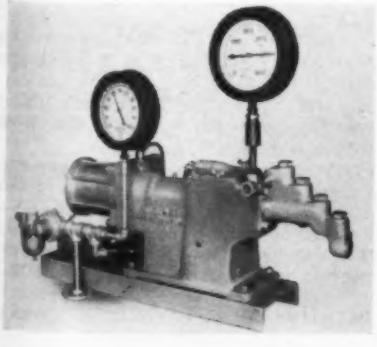
For additional information on any of these products, mark the end key numbers on the card bound in this issue and mail the card.

Gear Type Pump

Adel Precision Products Corp. have announced a new line of gear type hydraulic pumps designed for 1000 psi service with rated capacity at 1800 rpm of from 1.5 to 46.8 gpm. By keying the impeller to the driveshaft with balls placed in three grooves around the periphery of the shaft and shaftway, thrust loads are prevented from being transferred from the shaft to the impeller or end plates. Impellers float in the pump cavity. Trapped fluid pressure-lubricates shafts, bushings and bearings. Alloy iron housings, hardened steel gears and shafts, and special alloy bronze bushings are used. *1.*

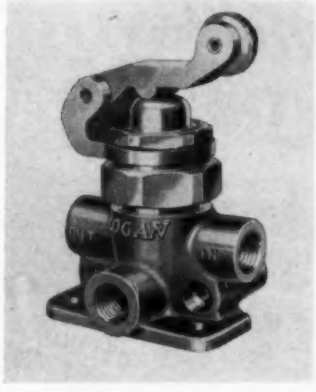
Hydraulic Test Pump

Milton Roy Company has developed a new "airROYmetric" pump for hydraulic testing of boilers, pressure vessels, piping systems, forgings and vacuum pumps. The pump is operated at full stroke length and maximum strokes per minute until the predeterminer hydraulic pressure in the system is approached. Then the pump operates at a speed necessary to maintain the required system. The relationship between the areas of the air piston and pump plunger balances the air pressure against the required hydraulic pressure. System pressures, calibrating and testing of pressure gauges up to 25,000 psi can be handled. *2.*



Air Control Valves

New two- and three-way as well as four-way, 2 position, ¼ inch port air control valves, designed for either side or base mounting, are announced by Logansport Machine Company. Both types are based on a single valve body to which a choice of accessory parts may be added to attain any of five types of operation. The two- and three-way valves are made for remote control of bleeder and pilot operated meter valves, control of single acting air cylinders and other uses. They are manufactured with only three ports, one of which may be plugged to make a two port valve. Types of operation are pushbutton, toggle, cam, air, cylinder and foot. The four-way, 2 position valves may be used as pilot operating valves for remote control of pilot-operated meter valves. *3.*

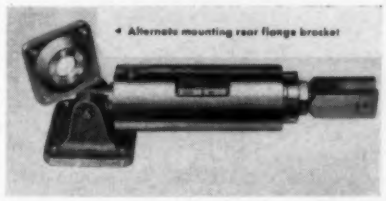


Compressed Air Aftercooler

For those who use small quantities of compressed air but who must have it delivered cool and dry for use, Jas. A. Murphy & Co., Inc., has made available a line of small, vertical aftercoolers. Two sizes are made; the smaller cools up to 20 cfm, the larger cools 30 to 50 cfm. Hot air and cooling water inlets are at the base, cooled air and water outlets are at the top. Separated moisture drops by gravity to a trap. *4.*

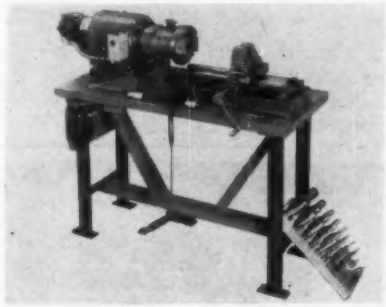
Double Acting Air Return Cylinder

Modernair Corporation has introduced an air return, double acting cylinder. After the initial charge of air, the cylinder operates on the same volume of air as a spring return cylinder. Field applications indicate that there is no residual pressure on the forward stroke. The return stroke is made at 60 percent efficiency with the use of a three-way valve. Since there is no metal-to-metal contact, replacement of "O" ring packing completely renews the cylinder. Elimination of the spring return element results in shorter overall dimensions, an advantage where space is limited. *5.*



Hose Assembly Machine

Aeroquip Corporation announces a hose assembly machine for faster assembly of Aeroquip hose and fittings. The machine will enable large users to make up their requirements of specific lengths of hose lines on a short notice and on a production basis up to 600 percent faster than by hand assembly. The assembly machine will accommodate all types of their standard fittings, including male pipe, swivel, flange and elbow type, and permit quick salvage of hose lines. *6.*



Jaw-Head Rawhide Hammer

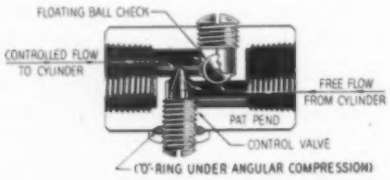
A new jaw-head hammer with replaceable rawhide faces was recently announced by Chicago Rawhide Manufacturing Co. Water buffalo hide, un-

available during the war, is again being used; this hide is the ideal striking surface, it does not become soft or brittle or chip, it does not load up with metal particles, mar or discolor finished surfaces. Replacement of faces involves only loosening of nut, change of faces and a tightening of the nut. The company offers a complete line of hammers and mallets. *7.*

CIRCLE NUMBERS ON THE CARD AND MAIL!

Flow Control Valve

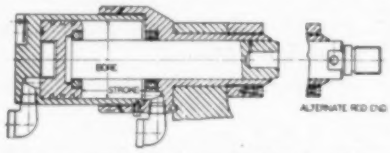
The Pneu-Trol flow control valve, for air and hydraulic cylinder speed control, recently developed by Pneu-Trol Devices, Inc. is now being made with dry-seal pipe threads to assure tight joints and eliminate air or fluid leakage at the pipe-valve connection. Incorporating a floating ball check, the valves are available in 5 sizes: ⅛, ¼, ⅜, ½ and ¾



in. Their compact body design permits consolidated piping arrangements. The floating ball check provides additional control. *8.*

Push Stroke Hydraulic Cylinder

A standardized line of "Hy-Power" hydraulic cylinders built for "push" stroke applications using up to 5000 psi is offered by Hannifin Corporation. The piston is a floating type with ground, precision step-seal rings. The cylinder body is heat treated alloy steel with precision ground bore. The high



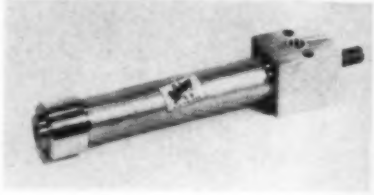
pressure end of the cylinder is of one piece construction and requires no sealing. Available in nine sizes ranging from 2 to 7¼ in bore and with strokes up to 6 in on largest sizes, the output force ranges from 7½ to 100 tons with 5,000 psi pressure on the head end of the piston. *9.*

Ferrule Crimping Tool

A. Schrader's Son Division, Scovill Manufacturing Co., Inc., has brought out a sturdy, yet light weight, portable ferrule crimping tool. For use when making "on the job" hose repairs, this simple tool utilizes, as the crimping medium, two strands of music wire in loop form attached to the operating handles in such a way that closing the handles contracts the loop. The tool is designed so that the same wires make a wide range of loop sizes to permit servicing of hoses from ½ to 1½ in outside diameter. *10.*

Corrosion Resistant Cylinder Valve

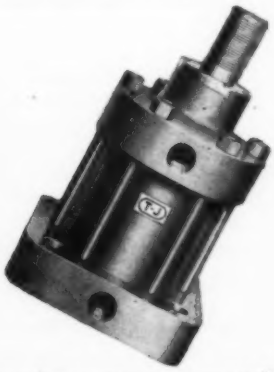
Airmatic Inc. has designed a corrosion resistant air and hydraulic cylinder valve fabricated from brass bar stock and with a pressure range up to 1500 psi. Standard cylinders are drilled and counterbored for mounting on the piston rod end, or for mounting on the side or foot. Double acting type is



standard. The valve may be used for light transfer, latching and tripping motion, as well as raising, lowering, pushing and clamping. *11.*

Neutral Valve

A new line of neutral valves is available, designed and manufactured by Valvair Corporation. When the valve is in the neutral position, all ports are blocked. It is then possible to stop and hold the piston of a single or double

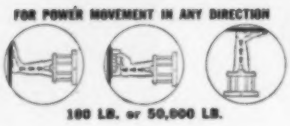


All moving parts are controlled hydraulically by T-J Cylinders—on this Malleable Nut Production Machine designed and built by Roy Hays & Associates, Rockford, Ill., for the Wagner Malleable Products Co., Decatur, Ill.

It's *fully automatic*—the operator only places nuts in stations. Nine T-J Cylinders, 40 ton to ½ ton, help complete the job of cutting off sprue, sizing, boring, facing, chamfering and threading 2,500-¾ std. pipe thread nuts per hour.

For your tough jobs of power movement—pushing, pulling or lifting—*save labor, speed production* and *cut costs* with T-J Air and Hydraulic Cylinders! Many standard sizes and styles . . . both cushioned and non-cushioned types . . . 100 lb. or 50,000 lb. Precision-built for long-life dependability. Write for latest catalogs. The Tomkins-Johnson Co., Jackson, Mich.

FOR POWER MOVEMENT IN ANY DIRECTION

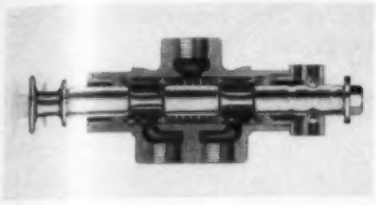


100 LB. or 50,000 LB.

T-J
TOMKINS-JOHNSON
RIVETORS...AIR AND HYDRAULIC CYLINDERS...CUTTERS...CLINCHORS

33 YEARS EXPERIENCE

acting cylinder in any position. The neutral position valve can be supplied with a knob, lever, clevis or treadle



operating mechanisms. It is available in ¼, ⅜, ½, ¾ and 1 in pipe sizes. Pressure range is from 0 to 175 psi. *12.*

Rotary Actuator

"Trim Trol" electric rotary actuator, for use on either low voltage dc or 110 volt ac, has been redesigned to give a compact unit weighing 2¼ lbs. Manufactured by Airborne Accessories Corporation, the unit produces 350 inch

pounds operating torque through 180 degree maximum rotation. Static capacity exceeds 1500 inch pounds. The unit incorporates zero backlash output, magnetic brake, built-in externally adjustable limit switches and potentiometer and radio noise filter. *13.*

Heavy Duty Compressors

Designated the XLE, a completely new L design, packaged-type, heavy-duty, electric-driven compressor line has been announced by Ingersoll-Rand Co. Sizes range from 125 to 350 hp for continuous full-load, two-stage compression to 80 to 125 psi discharge. The design embodies a single vertical low-pressure compressor cylinder, a horizontal high-pressure cylinder and a synchronous motor mounted directly on

the crankshaft. Mounting can be on skids or small foundation and machines are suitable for factories, mines, powerhouses and construction jobs. *14.*

AC Motor Starters and Contactors

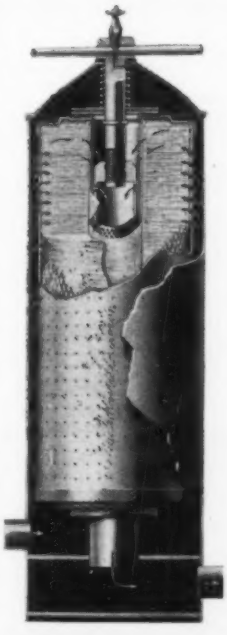
A line of ac magnetic starters, designed to conform to the latest NEMA Standards for Industrial Control, have been announced by the Square D Company. Standardized wiring and mounting dimensions have been adopted to simplify engineering, installation and maintenance of machine controls. Holding circuit interlocks are located to the left of the vertical centerline, as specified by NEMA; on sizes 0 through 3 straight-line guided motion of armature and movable contact assembly, providing trouble-free construction and long life. The design permits quick coil removal using only a screw driver. *15.*

High Vacuum Gage

An improved model No. 276-C, high vacuum indicating McLeod gage with a range from 50 microns down to 0.01 microns absolute has been announced by the F. J. Stokes Company. The improved design permits readings in just 10 seconds as compared with 2 minutes for the older design. Lightweight and portable, the new design has a frosted capillary which prevents mercury from sticking during tilting operations and is housed in a metal case 7 x 12 x 3¾ in overall. *16.*

REDUCE DOWNTIME *with* HILCO

HYDRAULIC OIL FILTERS TO KEEP YOUR OIL CLEAN



RP-1

★ A HILCO WILL PREVENT OIL SLUDGING - PUMP AND VALVE FAILURES

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POST SCRIPTS OF INDUSTRY

NEWS · VIEWS · TRENDS

B. N. Ashton, president, **Electrol, Incorporated,** has announced the election of **Houston E. Landis, Jr.** as vice president. Mr. Landis formerly was associated with Air Reduction Sales Co., having served as president of the Ohio Chemical & Manufacturing Co., and as vice president of Arcrods Corporation, two subsidiaries.

Mr. Landis

Roy M. Smith has succeeded G. E. Heberlein who has resigned as chief engineer of the **Railway and Industrial Engineering Co.**

Barksdale Valve Co., 4905 Santa Fe, Los Angeles, announces a cooperative distribution and sales plan whereby this company will act as national representatives for **Meletron Corporation,** 950 North Highland Ave., Los Angeles, and for **Crescent Valve Co.,** 6073 State St., Huntington Park, Calif. The plan is expected to result in better industrial distribution since the Barksdale company has representatives in every major city in the United States and Canada.

Fred L. Hansen has been appointed in charge of the sales of rotary, geared, vane and centrifugal pumps manufactured by the **Brown & Sharpe Mfg. Co.** Mr. Hansen was formerly with Brown & Sharpe of New York, Inc.

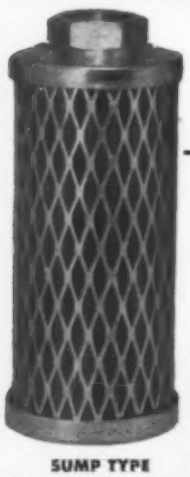
J. B. Farwell, president of **Sperry Products, Inc.,** has announced the appointment of **George Demougeot** as plant manager. Mr. Demougeot was formerly plant manager of the Ronson Art Metal Works, Inc.

Oliver W. Bonnafe was recently elected vice president in charge of research engineering at **The Lapointe Machine Tool Company.** Mr. Bonnafe has been associated with Lapointe for over 30 years and is well known for his contributions to the advancement of broaching. For his work in the war effort, Mr. Bonnafe in 1942 was given the Award of Merit by the Metal Trades Association. He is currently a member of the Advisory Committee for Machining of Jet Engine Components, working out of Wright Field.

Mr. Bonnafe

The Hilliard Corporation has recently added two new agents in

(Continued on page 42)



SUMP TYPE

1st Choice in an exacting field!

MARVEL SYNCLINAL FILTERS

Over 126 Manufacturers of HYDRAULIC MACHINES have picked Marvel filters as O. E.M. choice to guard their product.

2½ Times the Filtering Area of Like Size Circular Type Filters.

Dirt and foreign matter in oil cause over 50% of hydraulic machine troubles. Damage to pump gear, clogged ports and improperly seated valves result in pressure losses and slow unreliable action. Easily installed, and requiring minimum care. Marvel filters have cut maintenance costs up to 40% while effecting more and better production. Capacities (5 to 50 G.P.M.) and mesh sizes (Courses 30 to fine 200) available in both liquid line and sump types include the correct filter for your machine.

For efficient filtration of non-corrosive liquids in circulating and low pressure systems, Marvel has your answer. Write for catalogs 104 and 202.

LINE TYPE

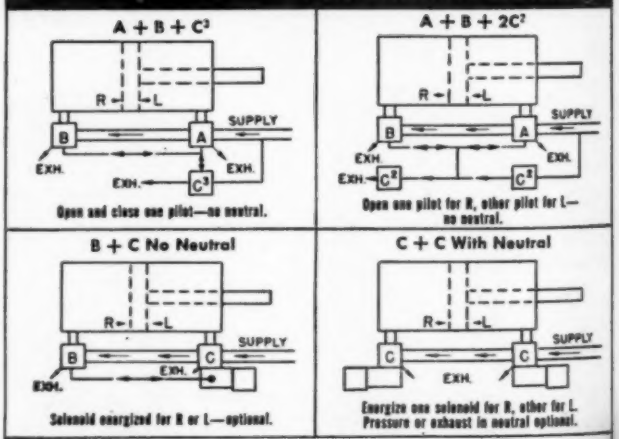
Marvel Engineering Co.

625 W. Jackson Blvd., Dept. 78, Chicago 6, Ill.

SOLVE AIR PROBLEMS

Easy as **A, B, C - -** /

WITH UNITIZED CONTROL



A – L3A Numatics Valve
B – L3B Numatics Valve
C – SL3 (L3A with solenoid pilot attached)
C² – Two-way pilot valve
C³ – Three-way pilot valve

Shown here are a few typical combinations obtained with "Unitized Control" . . . applied directly to the air cylinder.

INCREASE PRODUCTION —LOWER COSTS

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NUMATICS

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Precision Rubber Products Corporation

The only change ...is in the name!

Precision Rubber Products Corporation is the *new name* for your *leading* source of supply for "O" Ring Seals. Nothing else has been changed . . . Precision Rubber Products Corporation *will continue* to produce the *same* precision-built "O" Rings, using the same compounds and the same careful quality control as in the past.

Our *new name* accurately describes what we have been doing for many years . . . making precision "O" Rings and other close tolerance molded parts from rubber-like elastomers. *We Do Not Mold Any Plastic Parts.*

No change in quality, management or service. The same personnel you have dealt with in the past are anxious to serve you now. *The only change is in the name!*

Precision Rubber Products

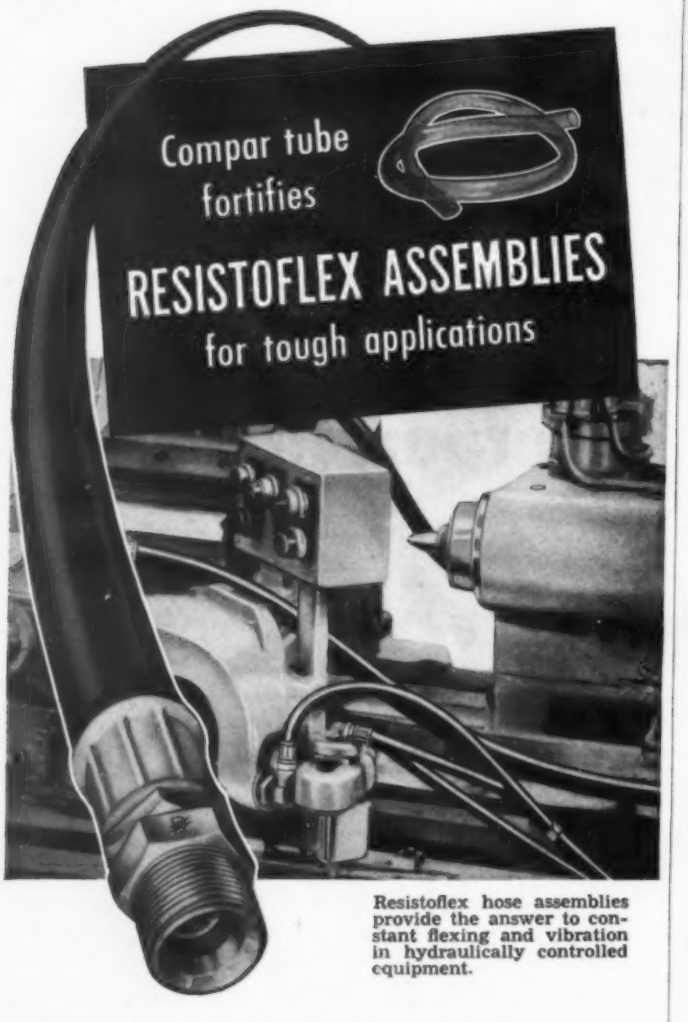
CORPORATION

Formerly Plastic & Rubber Products, Inc. Dayton, Ohio

The "O" Ring Specialists

Dept. 1, Oakridge Drive, Dayton 7, Ohio

Extra Strength in this Oilproof Hose!



Resistoflex hose assemblies provide the answer to constant flexing and vibration in hydraulically controlled equipment.

THREE REASONS explain why more and more manufacturers standardize on Resistoflex Hose Assemblies. These lines, containing no metal reinforcements, have: (1) Superior flexibility and are fatigue-proof. (2) High burst strength for medium as well as low pressure installations. (3) Complete impermeability to oils. All these advantages, of course, add up to fewer service troubles and replacements.

The extra durability of Resistoflex hose is assured by its unique construction. It has the compar tube. This high tensile tube not only reinforces the hose against shock loads, but also helps maintain clean systems because it doesn't swell, gum or erode in contact with oils.

If you have an application involving flow of hydraulic, lubricating or water-insoluble cutting oils, it will pay you to learn more about these light, cost-cutting, compar-tubed lines. Other assemblies available for gases, refrigerants or tough solvents. Write us about your problem, or for more information.

RESISTOFLEX
CORPORATION

Belleville 9, New Jersey

SYNTHETIC FLEXIBLE PRODUCTS AND PARTS FOR INDUSTRY

APPLIED HYDRAULICS DIGEST

Abstracts, summaries and listings of articles on hydraulic and associated applications in industry; reports on prepared papers, talk and discussions pertinent to the hydraulics field.

Computers—An Aid To Research

Albert A. Gerlach, *The Frontier* (house organ of Armour Research Foundation), March 1950, pp 8-11, 16-19.

A discussion of computers with an introduction dispelling the popular belief that the mechanical and electronic "brains" will ever supplant man.

Computers are divided into two distinct types: arithmetical, such as the digital computer or the more simple business machines; and second, the continuously acting machines, such as the electronic analog computer and various electro-mechanical devices used for the solution of problems arising in aircraft design and control, vibration analysis, design of industrial servo-mechanisms, controls, analysis of electrical circuits, turbines and internal combustion engines and in the design of mechanical structures.

The necessity of breaking down all mathematical computations into "short" discrete steps, requiring only the four simple arithmetical operations of addition, subtraction, multiplication and division, is pointed out as a characteristic of the digital computer. This involves considerable time for preparation if the required calculation is of complex form.

Continuously acting computers are more versatile in that they directly perform the four arithmetical operations in addition to many others, however, they have less potential accuracy.

The most modern and rapid type of continuous computers is the electronic analog. This computer is a device upon which an electrical analog representing a particular mathematical equation may be set up and the various unknowns in the equation measured at different points in the electrical circuits.

The article concludes with a discussion of the circuit diagrams and operation of the Goodyear analog computer purchased by the Armour Research Foundation and the solution of a simple representative problem.

Which Shaft Seal?

R. S. Rainey, *Product Engineering*, v 21, May 1950, pp 142-147.

Shaft tolerances, finish and hardness along with operating speeds, pressures and temperatures are some of the factors which influence seal choice. Leather seals are recommended for temperatures only up to 200 to 225 F; modern synthetic compounds are capable of

300 to 325 F. Design problems are introduced by shaft eccentricity, whip and runout. A tabulation of common fluid seals gives typical applications and operating limitations of speed and temperature. Twelve types of seals are discussed.

Seven Basic Types of Servomechanisms

Richard Herst, *Electrical Manufacturing*, v 45, May 1950, pp 90-95.

Servomechanisms can profitably be applied to processes which require proportional control and short time lags. In the "null-balance" control system, the output which is a function of the input, continually changes to keep the difference between output and input as close to zero as possible. The servomechanism uses electrical, hydraulic or pneumatic systems to automatically provide the desired output.

Almost all servo applications are covered by the seven basic types. Mechanical amplifier types provide power amplification. In remote positioning devices the input supplies the positioning information to the servo which moves the output until a balance results. For remote control the servo actuates some controlling device. Servos are applied to reaction measurements which include pressures and volumes. In pilot control, one servo controls a larger servo to provide faster response. The seventh type, automatic control, which may be applied to speed, fluid flow, mechanical displacement and voltage regulation, offers the greatest field for servo applications.

(Continued on page 44)

BETTER BRONZE PARTS FOR ALL TYPES OF PUMPS

American Crucible methods, know-how, experience and equipment result in highest quality parts at attractive savings to you.

Thrust plates, bearing plates, pressure plates, bushings, seals and connecting rods, machined or rough cast from

PROMET THE Engineered BRONZE

of the specific formula best suited to each application. That's why they carry a

MONEY-BACK GUARANTEE OF LONGER SERVICE—LOWER MAINTENANCE COST.

PROMET BRONZE BAR STOCK

Round, solid or tubular. Rough cast or fully machined. Cored stock all sizes (by ⅛" steps) from ½" minimum core to 26" O.D. and 13" lengths or less. Six grades of hardness.

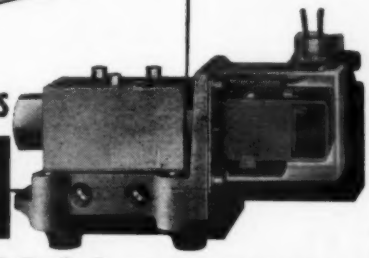
Write for literature or let us make recommendations and quote you. Simply send blueprints, conditions of operation and other data.

THE AMERICAN CRUCIBLE PRODUCTS CO.
1303 Oberlin Avenue • Lorain, Ohio

NEW INEXPENSIVE

High Cycle SOLENOID VALVES

⅛" and ¼ sizes up to 300 cycles per minute



.. for air to 125 P. S. I. — or vacuum also low pressure hydraulic service

● These valves combine the utmost simplicity in design with rugged construction. They will give millions of cycles of highly satisfactory and efficient trouble-free service. Small solenoids, with short strokes, work against the valve plunger eliminating levers, links and pins. Low amperage requirement eliminates intermediate relays and simplifies electrical control circuits. Side or bottom pipe connections. 2, 3, 4 and 5-way actions.

Write today!

Write for Data Sheet No. 1741.

Mfd. by **C. B. HUNT & SON, Inc.,** 1963 E. Pershing St., Salem, Ohio

"The Higher the Pressure — The Tighter the Seal"

Quick-As-Wink

AIR AND HYDRAULIC CONTROL VALVES

if it can use hydraulics

CALL HUFFORD!

Wherever mechanical motion is required, there's a possibility of using Hydraulics to advantage—for economy, speed, smoothness, or greater operating efficiency.

HUFFORD, one of the Pacific Coast's leading exponents and builders of Hydraulic Equipment, can help you. For engineering recommendations and estimates, *call on us.*

HUFFORD • HYDRAULICS •

HUFFORD MACHINE WORKS, INC.

Redondo Beach, Calif.

Builders of the famous Hufford Hydraulic Stretch-Wrap Forming Machines, Hydraulic Ceramic Presses, Hydraulic Elevators, and Specialized Hydraulic Machinery.

(Continued from page 38)

their sales department. They are **Samson Sales Company,** 420 Market Street, San Francisco, California, and **Central Station Engineering Co.,** 2323 Aviation Highway, Tucson, Arizona.

Carl E. Schmitz, vice president, Crane Packing Company, was elected vice president-at-large of the **American Society of Lubrication Engineers.** His other current activities include chairmanship of a subcommittee on engine design for the SAE and membership on the conference committee of the National Conference on Industrial Hydraulics.

Mr. Schmitz

Linear, Inc. announce the extension of their Pacific Coast representation to the San Francisco area and northern California. **The Haskel Engineering & Supply Company,** Linear's exclusive west coast representative, with main offices at Glendale, California, has opened a full service branch office at 1245 22nd Street, San Francisco.

In an announcement by J. S. Bennett, vice president of the **American Engineering Company, John C. Mevius** has been named sales manager of the Hydraulic Division. Mr. Mevius continues to be responsible for materials handling sales, and will be assisted in hydraulic sales by **G. A. Fleck.**

"O" RINGS SINCE 1941

Outstanding by nature—Parco Balanced Compounds + precision moulding make the outstanding hydraulic packing. For "O" ring packing, investigate "O" rings from Parco Balanced Compounds. All dash numbers of both 6227 and 6230 series for commercial application or Army-Navy installations to Specification ANP 79 are available from stock.

Catalog and engineering data on request. Write us today.

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Plastic & Rubber Products Co.

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919 N. Michigan Ave., Chicago, Ill.

John C. Cotner has been appointed president of **The Hydraulic Press Mfg. Co.** of Mount Gilead, Ohio. A veteran in the hydraulics industry, Cotner served Logansport Machine Co., Inc., for 20 years as vice president and general manager, and as president and during 1945-1946 he was vice president of Gerotor May, Inc. Cotner brings an extensive background of management and production experience in the hydraulic machinery field to HPM. A native of Logansport, Indiana, Cotner is also president of the Logansport Broadcasting Corporation and secretary-treasurer of Tec Engineering Company of Logansport.

Mr. Cotner

Hamilton Merrill, vice president and director of Manning, Maxwell & Moore, Inc., has been appointed vice president in charge of **Consolidated-Ashcroft-Hancock** Division of the company.

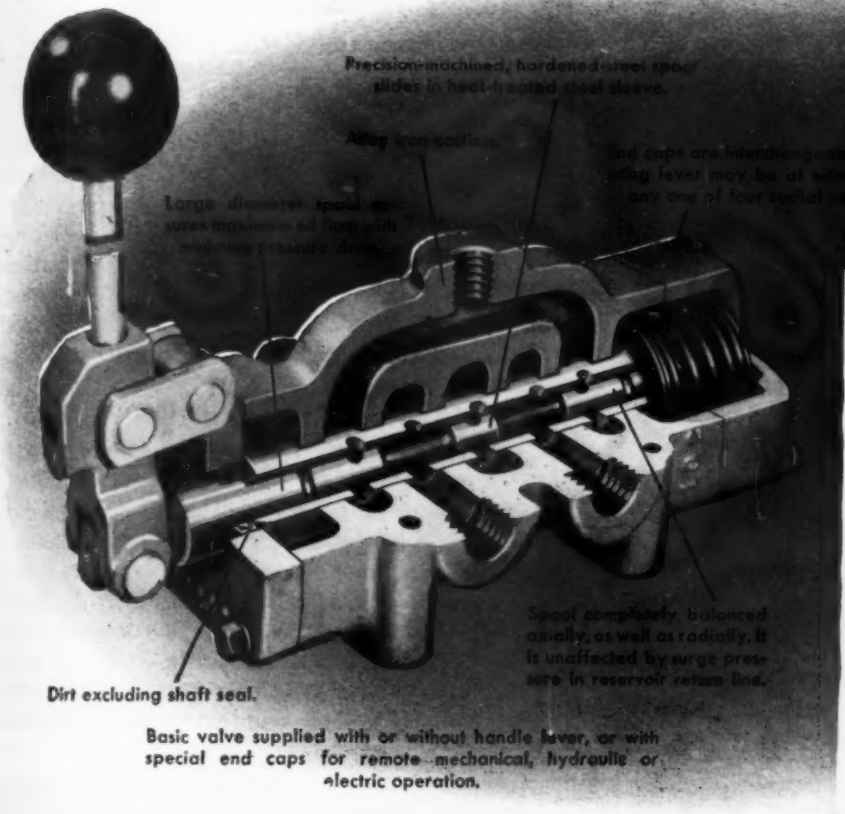
The **John S. Barnes Corporation,** Rockford, Illinois, has announced the opening of a Philadelphia sales office which will be operated by **Ernest A. Isberg and Company,** Theater Square, Swarthmore, Pa.

George R. Weber has been elected treasurer of **Raybestos-Manhattan, Inc.** Mr. Weber has been a director and vice president of the company since its formation in 1929. **W. S. Simpson** was elected as secretary and **W. Ward Kievit** a director of the corporation.

L. J. (Les) Henderson has rejoined **The Weatherhead Company** of Cleveland, Ohio, as Sales Manager of the Aviation Division. During the war years, Mr. Henderson distinguished himself as an authority on aviation production problems and is well known throughout the industry. At that time, he was Assistant General Sales Manager for The Weatherhead Company. For many years, he has been a member of the SAE and continues as Chairman of Committee A-3, which covers valves, fittings and flexible hose assemblies.

THE *Under-Cover Features* OF THE

New Adel Hydraulic Selector Valve


Precision-machined, hardened-steel spool slides in heat-treated steel sleeve.
Alloy iron casting.
End caps are interchangeable. Operating lever may be at either end or at any one of four radial positions.
Large diameter spool ports assure maximum oil flow with minimum pressure drop.
Spool completely balanced axially, as well as radially. It is unaffected by surge pressure in reservoir return line.
Dirt excluding shaft seal.
Basic valve supplied with or without handle lever, or with special end caps for remote mechanical, hydraulic or electric operation.

ADEL OFFERS 4-WAY VALVES IN A VARIETY OF MODELS TO MEET ALL OPERATING CONDITIONS

Lever Operated 4-Way Valve For Manual Control

Mechanically-Operated, 4-Way Valve For Remote Manual Control

Pilot-Operated 4-Way Valve For Remote Hydraulic Control

Single Treadle 4-Way Valve For Foot Control

6, 12 or 24 Volt DC Solenoid-Operated 4-Way Valve For Remote Electrical Control

110 AC Solenoid-Operated 4-Way Valve For Remote Electrical Control

Cam-Roller Operated 4-Way Valve For Automatic Control

Unlimited flexibility...quiet, shockless operation ...low pressure drop...long, dependable service! These are the operating characteristics of the new ADEL line of hydraulic oil control valves. Simple, spool-type construction permits wide variety of porting arrangements for either open-center or closed-center hydraulic systems. Standard 4-way valves available with spring-centered, spring-offset, or three position detent action.

Manufactured in ¼", ⅜", ½", ¾" and 1" pipe thread port sizes for 1000 psi service. Flows to 32 gpm.

Write for new, descriptive bulletin containing detailed information on ADEL's line of industrial hydraulic equipment. Please address inquiries to 10755 Van Owen Street, Burbank, California.

ADEL

ADEL PRECISION PRODUCTS CORP.

BURBANK, CALIF.

A FEW SELECT TERRITORIES ARE STILL AVAILABLE TO PROGRESSIVE DISTRIBUTORS OF HYDRAULIC EQUIPMENT - INQUIRIES INVITED

HANNIFIN AIR CONTROL Valves

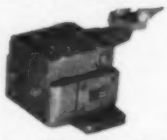
NEWEST TYPES! EXCLUSIVE DESIGNS for EVERY PURPOSE!

THE Hannifin line of Air Control Valves is complete—sizes and types for every purpose! Hannifin leads with newest, exclusive designs for fast, effortless control of air cylinders, presses, and other air operated equipment. Ask for recommendations.

"PACKLESS" HAND OPERATED

Simple, smooth-acting, positive 3-way or 4-way valves. "Packless" rotary disc type. Self-lapping. Sizes from ⅛" to 1¼". *Ask for Bulletin 57W.*

"EFFORTLESS" HAND OPERATED



Fast, new, finger-tip, pilot operated sliding disc valve. Effortless; air pressure does the work! For single or double acting cylinders. *Ask for Bulletin 241.*

"PACKLESS" FOOT OPERATED

Treadle type; leaves operator's hands free for other work. Tight-sealing, self-lapping, rotating bronze disc. Sizes ¼" up to ¾". *Ask for Bulletin 57W.*

"EFFORTLESS" FOOT OPERATED

Fast, new, pilot operated, disc type valve. Light, effortless action. Rugged construction. With or without pedal guard. *Ask for Bulletin 240.*

HANNIFIN CORPORATION

1155 South Kilbourn Avenue — Chicago 24, Illinois

DIGEST

(Continued from page 41)

Compressed Air Power

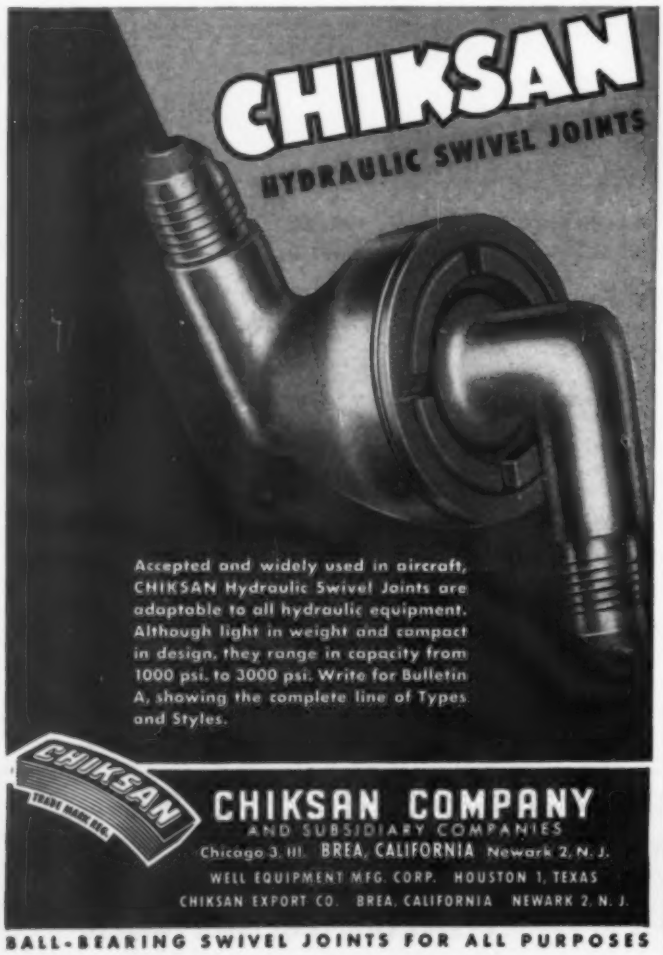
Prepared by Committee on Engineering Education of Compressed Air and Gas Institute.

This report presents many of the properties and commercial uses of compressed air. The possibilities of compressed air as a power source are stressed. Applications include air motors, air hammers, atomizing, conveying, instrument control and linear actuation. The basic theory and practical methods of compressing air are illustrated. Various types of compressors and their operation are described.

Compressed Air In Industry

D. Y. Marshall, *Compressed Air Engineering*, v 15, May 1950, pp 51-56.

Compressed air provides a flexible, compact and convenient method of power transmission. Air operated tools and devices have become, in the last fifty years, an essential part of industrial equipment. Proper planning, selection and installation of a compressed air plant will provide a sufficient quantity of air at a pressure suitable for the efficient operation of all machines using air power. Planning requires consideration of the



Accepted and widely used in aircraft, CHIKSAN Hydraulic Swivel Joints are adaptable to all hydraulic equipment. Although light in weight and compact in design, they range in capacity from 1000 psi. to 3000 psi. Write for Bulletin A, showing the complete line of Types and Styles.

CHIKSAN TRADE MARK REG. U.S. PAT. OFF.

CHIKSAN COMPANY
AND SUBSIDIARY COMPANIES
Chicago 3, Ill. BREA, CALIFORNIA Newark 2, N. J.
WELL EQUIPMENT MFG. CORP. HOUSTON 1, TEXAS
CHIKSAN EXPORT CO. BREA, CALIFORNIA NEWARK 2, N. J.

BALL-BEARING SWIVEL JOINTS FOR ALL PURPOSES

GEROTOR hydraulic MOTORS

a rotary power source with unique advantages

GEROTOR Hydraulic Motors can be stalled under load without damage, operated safely in explosive and corrosive atmospheres, installed in confined spaces. Low rotational inertia. Two models with plain, base or flange mounting—for direct coupling, belt, chain or gear drive. Sizes up to 8.7 h.p. Write for Catalog G-108.

GEROTOR hydraulic pumps & motors

GEROTOR MAY CORPORATION, Baltimore 3, Md.

Device Load Factor, Equipment Load Factor and the Overall Load Factor. DLF is the ratio of actual air consumption to the maximum full load consumption for one device; ELF is a similar ratio for all units, and the OLF is the product of DLF x ELF.

The economy of two stage compression which results in a power saving of 20 percent over single stage compression, usually warrants the extra first cost for this compressor.

Operating charges, depreciation and interest are the cost factors of compressed air. Power costs at full load operation represent 72 percent of the total cost. High power costs make necessary the use of unloaders and speed regulators.

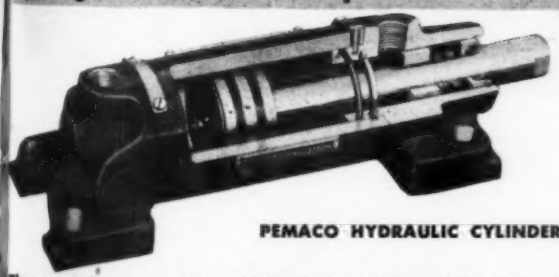
Mr. Marshall presents a guide for ordering and comparing air compressor units along with installation rules for space and foundations. The influence of temperature and cleanliness on air intake to the compressor is discussed.

Air Motors for High Speed

Roger W. Bolz, et al, *Machine Design,* v 22, April 1950, pp 177-185.

Turbines and positive displacement motors are the two basic types of air motors. Turbines can be operated in the ultrahigh speed range of 30,000 to 100,000 rpm, however, at these speeds power output is in the range of ¼ hp. While vane type motors can attain 25,000 rpm, they are most efficient at 3000 to 5000 rpm. As compared to turbines, vane motors can better carry

PEMACO HYDRAULIC AND AIR CYLINDERS
Designed to J.I.C. Hydraulic Standards



PEMACO HYDRAULIC CYLINDER

The reputation enjoyed by PEMACO for building first quality hydraulic and air cylinders was not acquired by chance. Sound engineering, modern design, the finest materials combined with years of experienced craftsmanship, has resulted in recognized acclaim throughout industry.

Check these 11 points of superiority of the PEMACO HYDRAULIC CYLINDER:

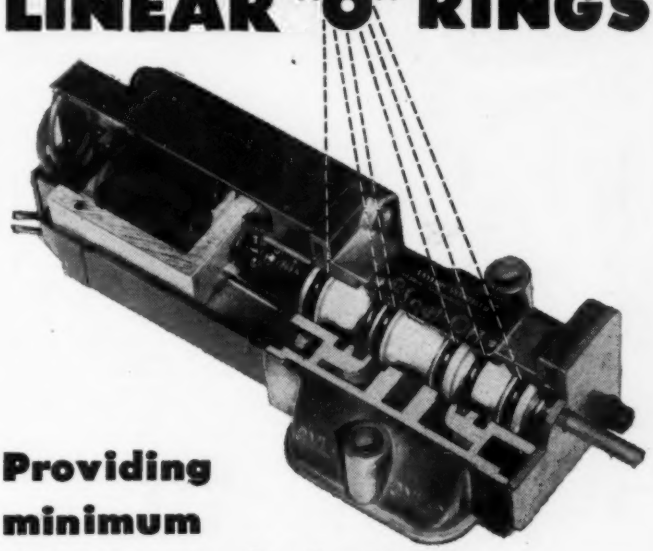
- "Heavy duty" hi-tensile cast iron castings (steel castings optional).
- Ample bronze bearing—oriented behind packing to reduce surge pressure.
- New type, low friction ram seal.
- "Seal guard" ram scraper gives positive packing protection.
- 50 Rockwell — hardened and grounded steel ram — score resistant.
- Automotive type piston rings.
- "O" ring seals.
- Internal snap type keeper ring.
- Piston and ram positively secured by patented lock nut.
- Precision honed steel tubing.
- Designed to J.I.C. Hydraulic Standards.

Write for complete information and engineering data.

PETCH MANUFACTURING COMPANY

2769-71 HARPER ST.
MT. CLEMENS, MICH.

CRITICAL TOLERANCE REQUIREMENTS met with LINEAR "O" RINGS



Providing minimum friction and air-tight operation for Seal-Off air valve

The long life and dependability of the Taylor-Winfield Seal-Off air valve result from simplified design and construction together with the close machining tolerances of the mating parts. As a companion to superb workmanship, LINEAR "O" Ring seals were selected for their closely held dimensions.

Correct fit of the seals is an absolute must, to keep frictional drag at a minimum . . . permitting the use of a small solenoid . . . and avoiding undue friction on moving parts. In addition, the seals are compounded of a special synthetic material which resists volume change in the presence of lubricating oil.

Meeting such sealing needs is not uncommon with LINEAR. Thousands of products *throughout industry* are effectively and efficiently using economical, versatile, precision moulded LINEAR "O" Rings . . . for a host of sealing applications, over a wide range of temperatures and pressures.

Compounded of natural or synthetic rubber for nearly every condition, LINEAR "O" Rings are also available in Kel-F, Silicone and other synthetics to resist the action of vigorous oxidizing materials. LINEAR has a complete list of J.I.C. and A.N. standard sizes as well as hundreds of non-standard "O" Rings for special uses.

For individualized attention to your packing problem, design or application, CALL LINEAR!

"PERFECTLY ENGINEERED PACKINGS"
LINEAR
LINEAR, Inc., STATE ROAD & LEVICK ST., PHILADELPHIA 35, PA.

WHEN YOU CAN'T FIND THE SPECIAL
CYLINDERS YOU NEED
REMEMBER, HYDRO-LINE BUILDS 'EM

Illustrated is only one of many special cylinders we have designed and built for various industries and applications. Our engineers are always ready and willing to work with you on those knotty problems that involve pushing, pulling or lifting.

STANDARD AIR AND HYDRAULIC CYLINDERS

In addition to special cylinders we manufacture a complete line of standard air and hydraulic cylinders. These all conform to J.I.C. standards and have outstanding features for long life and efficient performance.

FREE
ADDITIONAL DATA

covering additional construction and performance features are included in our catalog. Write for your copy today Ask for bulletin A-750.

Illustrated is a high pressure hydraulic cylinder for hydraulic testing press. Cylinder has 12" bore, 6" stroke and withstands up to 4500 P.S.I.

Hydro-Line

HYDRO-LINE MFG. CO.
716 19th STREET
ROCKFORD, ILLINOIS

loads without wide variations in speed. Piston type air motors provide a high starting and running torque. Maximum speed for piston type motors is between 2000 and 4500 rpm.

When overloaded air motors slow down and stop without damage to the unit. Advantages include compactness, infinitely variable speed range, fast response, and cushioning effect against shock load. Disadvantages are noisy exhaust unless muffled, low overall efficiency, sensitivity to load variations and high operating cost.

Tubing for Hydraulic Circuits

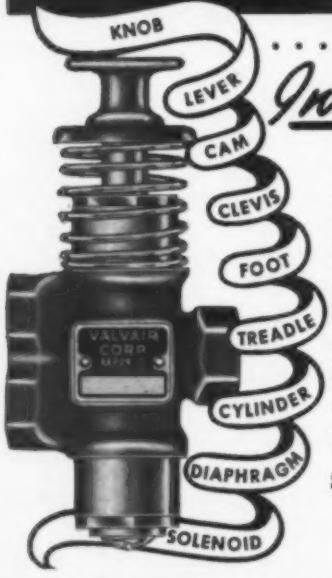
Editor, Product Engineering, v 21, June 1950 pp 137

Factors to be considered for the economical use of tubing include economy of space and ease of fabrication. Angle turns without fittings reduce installation costs. Weight is saved by using tubing connectors which do not require extra wall thickness for threading. Avoid abrupt changes in direction of flow to keep turbulence low. Tubing helps to damp out vibrations.

Use standard fittings wherever possible. Consider the use of special fittings to reduce the number of joints, installation and labor costs, and to save space.

Layout tubing to avoid interferences and abuse from external sources. Allow for expansion and contraction. Provide adequate radii for bends and proper support for tubing and accessories. Locate lines for convenient maintenance.

VALVAIR GIVES YOU . . .
Any CONTROL ASSEMBLY
ON A STANDARD VALVE BODY



. . . because parts are *Interchangeable*

Cylindrical ends on all valve bodies (in respective sizes) are identical, making possible *any control assembly.* Internally, stem, spacer, packer spreader, flange end bearings, and spring are interchangeable. Save on maintenance and stock; save by paying less for valves which embody standardized parts.

★ ★ ★

Sizes: ¼", ⅜", ½", ¾", 1".

★ ★ ★

Ask for Bulletin "A-H".

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AFFILIATE: SINCLAIR-COLLINS VALVE CO.

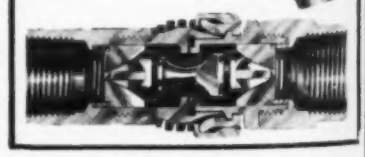
Rely Upon Valvair
2-WAY 3-WAY 4-WAY

WHEN YOU . . .
Disconnect, You Stop the Flow in *Both* Ends

Wherever the flow of air, fluids, or gases must be interrupted, Wiggins *INST-O-MATIC* couplings are lowering costs. Uncouple a Wiggins. You've automatically stopped the flow in both ends. Connecting, or disconnecting, is as simple as switching on a light. Wiggins *INST-O-MATIC* couplings can increase efficiency in your plant today, and lower costs.

EQUIPMENT MANUFACTURERS

Users' experiences prove conclusively that this design stands up longer under extreme pressure and vibration, and rarely requires replacement. Inquire today.



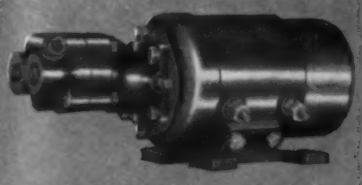
BASIC SIZES: ¼", ½", ¾"; also intermediate sizes where needed. Unconditionally guaranteed to be leak proof from 0 to maximum recommended pressure.

Wiggins

QUICK DISCONNECT
INST-O-MATIC COUPLINGS

For proof of performance, write for name of nearest representative.
E. B. WIGGINS OIL TOOL CO., INC., 3424 E. Olympic Blvd., Los Angeles 23, Calif.

Another Job for Pesco HYDRAULIC MUSCLES



Illustrated above is a Pesco electric motor-driven hydraulic pump of the type used on smaller automatic trucks. It has a displacement of .043 cu. in. Capacity is .67 g.p.m. at 3000 p.s.i. at 33 volts D.C. and 76 amperes

A Pesco pump is lifting this load...

IT COULD LIFT OVER TWICE AS MUCH!

Over 80,000 pounds can be lifted and transported by this die handler built by Automatic Transportation Company.

Yet the Pesco hydraulic pump that supplies the power to lift such terrific loads is so small it can be carried easily in your hand!

One important reason why more and more industrial equipment manufacturers are turning to Pesco for answers to their hydraulic power problems, is *"Pressure Loading"*. *"Pressure Loading"* is the exclusive, patented Pesco design principle that assures extremely high operating efficiencies over a long, trouble-free pump life because it *automatically* compensates for wear.

For the complete story of *Pesco Pressurized Power and Controlled Flow,* and how the sales power of Pesco hydraulic power can help you, write today.

A preliminary discussion will involve no obligation.

engineering Pesco production

PRODUCTS DIVISION

BORG-WARNER CORPORATION

24700 NORTH MILES ROAD BEDFORD, OHIO

The dress that needn't have been so beautiful

THERE'S NO REAL REASON for a girl to have the most beautiful dress in the world. Even my daughter Sally. Even if she has her heart set on it.

But—I bought it. And when I paid the bill, I whistled! Partly with the well-known father's bill-shock. Partly for happiness. Because, Sally was right—there never *was* a prettier dress to get married in.

It's times like that—when we can buy something really important even if it is a luxury—that I feel like such a lucky guy.

And times like when my wife got sick, and we could give her the good care she needed to get well. And the swell day-in, day-out feeling of *knowing* that if an emergency comes, you've got the money to meet it.

I know the luckiest day of my life was when I signed up to save regularly through the Payroll Savings Plan at the office. I'd tried every which way to save before, but, brother, this *automatic* way is the only way that *works—for you—all the time!*

Buying U. S. Savings Bonds . . . whether by the Payroll Savings Plan or the Bond-A-Month Plan . . . is the safest, "foolproofest," easiest method of saving since money was invented. And every $3 you invest will turn into $4 in just 10 years.

Automatic saving is sure saving—
U.S. Savings Bonds

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